ENVIRON

June 14, 2013

VIA ELECTRONIC DELIVERY

Ms. Laura Tesch
Pebble Limited Partnership
3201 C Street, Suite 604
Anchorage, Alaska 99503

RE: Docket ID No. EPA-HQ-ORD-2013-0189
ENVIRON Technical Review Comments

Dear Ms. Tesch,

In response to your recent request, ENVIRON International Corporation (ENVIRON) has completed the draft technical review of the United States Environmental Protection Agency (USEPA) Revised Bristol Bay Assessment report titled "An Assessment of Potential Mining Impacts on Salmon Ecosystems of Bristol Bay, Alaska, Second External Review Draft EPA 910-R-12-004b, dated April 2013 ("the Assessment"). With this letter, please find the following attachments:

Attachment A – Summary of the detailed technical comments identified during the review of the Assessment;

Attachment B – Technical comments on the Assessment in spreadsheet format, organized by subject matter; and,

Attachment C – The resumes of the ENVIRON professionals who prepared these comments.

In summary, ENVIRON found the Assessment improved in some technical areas, mainly relating to information on baseline ecological resources. However, with respect to the theoretical mining activities and potential impacts on the Bristol Bay watershed, the Assessment continues to have significant deficiencies in technical quality, relevance, and objectivity. The document continues to assume that a mine would be developed that does not meet State and Federal requirements for environmental protection, and adequate supporting technical information is still not provided. The inclusion of new information on possible compensatory measures is, at best, qualitative and wholly inadequate, particularly since the assessment did not incorporate measures that are reasonably assured to be included into a project. The USEPA has not achieved the standards set for itself and by the National Federal Data Quality Act regarding both data quality and scientific rigor.

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Our Team welcomes any questions or comments that you may have. Laura can be reached at (907) 563-0515 and by email to lnoland@environcorp.com. Rick can be reached in at (510) 420-2556 or (925) 209-5268 and rjwenning@environcorp.com.

Sincerely,

ENVIRON International Corporation

Richard J Wenning
Principal

Laura J. Noland
Senior Manager

cc: Domoni Glass, ENVIRON

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Attachment A
Summary of ENVIRON's Technical Review

"An Assessment of Potential Mining Impacts on Salmon Ecosystems of Bristol Bay, Alaska, Second External Review Draft EPA 910-R-12-004b, dated April 2013 ("The Assessment")

While the Assessment has been restructured extensively and some new material added, in many ways, the fundamental approaches followed and conclusions reached in the first draft of the Assessment are preserved in the current draft. As such, the same concerns raised by ENVIRON International Corporation (ENVIRON) in technical comments submitted to The Pebble Limited Partnership (PLP) concerning the original Assessment are still valid and apply to the current revised draft document. The following presents a summary of the specific findings presented in Attachment B and the important technical shortcomings in the document prepared by the United States Environmental Protection Agency (EPA).

Summary of Findings

Overall, we found that EPA did make some changes in the document reflecting some of the comments provided by PLP during the April 2012 public comment period. However, over half of the technical comments submitted to the Agency were not addressed by EPA in any manner, and roughly one-quarter of the technical comments were only partially addressed. Additionally, EPA was inconsistent in incorporating the requested changes throughout the new draft; changes were made in some sections, but not in other sections of the document. Even when new information was included or reviewed, EPA frequently failed to change the overall conclusions when it was apparent that the new information fundamentally altered the analysis and conclusions of the analysis.

Ecological Information in the Assessment: The Assessment is slightly improved in some technical areas, mainly relating to information on baseline ecological resources and incorporating some environmental field studies into the revised document, however the Assessment fails to incorporate the majority of the Pebble Environmental Baseline Document (EBD) environmental and socioeconomic data.

Flawed Assumptions Regarding Construction and Operation Affect Quality of Entire Assessment: With respect to the theoretical mining activities and potential impacts on the Bristol Bay watershed and salmon ecosystem, the Assessment remains wholly lacking in technical quality, relevance, and objectivity. In the fact sheet released concurrently with the revised Assessment, EPA identified six key changes to the Assessment (http://www2.epa.gov/bristolbay/bristolbay -assessment-fact-sheet-april-2013).

Among the six changes was the assertion that the Assessment incorporated modern conventional mining practices into each of the mine scenarios. The mining, transportation, and pipeline scenarios continue to assume construction will not meet current regulatory requirements. This assumption is unwarranted based upon our experience with modern resource development projects in the United States. EPA's fundamental underlying assumptions regarding construction and operation of a project of the scale assumed in the Assessment are unfounded. Perpetuating this incorrect assumption grossly overstates the

likely impacts of a project in the Bristol Bay watershed.

Furthermore, the three refined mine scenarios presented in the Assessment do not reflect current worldwide industry standards for porphyry copper mining. Throughout the document, the Agency presumes a level of environmental performance by the mining industry that is entirely unsubstantiated and assumes a level of performance that would violate current State of Alaska and federal laws. Contrary to statements in Chapter 6 of the report (page 6-1, par. 2), the three mine scenarios do not represent realistic, plausible descriptions of potential mine development alternatives that are consistent with current engineering practice and precedent. In addition it is extremely unlikely that the three mine scenarios as presented in the Assessment would be able to obtain State, Federal, and local government permits and approvals required to construct and operate a large hard rock mine in Alaska. The scientific and industry literature presented in Chapter 4 and Appendix H describing mines around the world may not be, contrary to EPA claims, either realistic or plausible. Several of the mine examples described in the Assessment were not developed in compliance with laws and regulations currently in effect in the United States.

A second area of improvement claimed by EPA in its fact sheet was the inclusion of new information concerning mitigation measures. Appendices I and J describing potential mitigation methods for impacts to wetlands, streams and fish represents, at best, a limited and qualitative evaluation. The appendices to the Assessment generally do not address mitigation measures in sufficient detail to evaluate their relevance as mitigation measures in the three mining scenarios. Further, the discussion of mitigation options is incomplete and covers only a subset of potential compensatory mitigation approaches. The Assessment improperly continues to assume that few, if any, compensatory mitigation measures will be adopted for a project in the Bristol Bay watershed. For instance, the Assessment continues to assume that undersized culverts will be used, creating flow restrictions; the potential impacts associated with undersized culverts could be avoided easily. The Assessment's failure to present realistic mitigation measures, as would be required for any 21st century mine prior to development invalidates EPA's statement that new information has been submitted concerning mitigation measures.

Many sections of the Assessment also continue to assume that leachate would migrate from mine tailings to groundwater. The EPA fails to acknowledge that modern control methods are available and could be incorporated in the project design to minimize or avoid this potential concern. Because the Assessment assumes that a project would not implement adequate design or mitigation measures addressing concerns about potential groundwater impacts, the Assessment overstates potential impacts on groundwater quality. Additionally, Appendices I and J and the text boxes inserted throughout the document intended to address mitigation are incomplete, and fail to identify numerous approaches that are commonly used to avoid such impacts.

In addition to the failure to incorporate modern design construction standards and appropriate mitigation measures, the document continues to assume that a mine cannot be adequately closed and that substantial impacts will continue to occur hundreds or thousands of years after operations have ceased. Some discussion of Alaska's bonding requirements has been added in a text box, but the text in Section 6.3 presumes that some closure issues will be

unresolvable. The text box inappropriately implies that adequate bonding will not be available. Such speculation is entirely inappropriate in a scientific document. The ability to successfully close a mine is a critical performance measure in both State of Alaska and federal permitting processes. Given the State of Alaska's permitting and bonding requirements, statements suggesting or implying assumptions that a project has unresolvable closure issues reflects bias and is not realistic. Any mine development project that cannot meet the rigorous State of Alaska bonding requirements would not be allowed to proceed. These types of assumptions affect the quality and integrity of the entire Assessment. The conclusions in the EPA's Assessment regarding the effects of mine development on fish, wildlife, cultural resources, and water quality are inappropriate assumptions to apply to 21st century mines which are required by regulatory authority to establish an approved mine closure plan prior to construction.

Failure to Meet the Federal Data Quality Act: The Federal Data Quality Act requires that analyses completed by federal entities meet certain standards. The standards are specified in EPA guidance and include: (a) an independent reanalysis of the original or supporting data using the same methods to generate similar analytical results, including documentation of methods and identification of data sources, (b) use of best available science, and, (3) preparation of an objective document and analysis. The Assessment fails to meet all three of these prescribed standards.

The Assessment is not an Ecological Risk Assessment. EPA identified one of the key areas of improvement as a reorganization to better reflect the ecological risk assessment approach and to clarify the purpose and scope. The reorganization of the work presented in the Assessment does not improve consistency with the EPA's ecological risk assessment methodology. The Agency no longer refers to the assessment as a watershed assessment (which it never was), and now refers to the work as simply an "assessment". The executive summary states that the report follows EPA's ecological risk assessment framework (page ES-4, par. 2), yet the report does not meet its own guidance for performing either a baseline ecological risk assessment or screening-level risk assessment (http://www.epa.gov/oswer/riskassessment/ecorisk/ecorisk.htm).

EPA's Incorrect Claim that the Assessment is not an Assessment of a Specific Mine: The three mine scenarios examined in the Assessment, referred to in the assessment as "Pebble 0.25 ", "Pebble 2.0", and "Pebble 6.5", do not reflect specific or even preliminary mine plans submitted to state and federal agencies related to the Pebble Mine project. Further, by attaching the word "Pebble" to each of the mine scenarios the Agency inappropriately promotes the gross misperception to the public that the Assessment directly addresses a specific mine project. This misapplication of "Pebble" is contrary to the statement in the Assessment that the document: *"….is not an assessment of a specific mine proposal for development"*.

Exaggerated Evaluation of Water Use: The additional information included in the Assessment describing water use (i.e., water loss, water quality impacts on stream reaches, drainage of waste rock leachate to streams, and mine site water balance to assessment) and the impact of spills and truck accidents in the potential transportation corridor are grossly exaggerated. The Assessment lacks credible information on the scope and scale of water use and environmental impacts. The failure analyses included in the discussion of potential

transportation corridor(s) fails to reflect prospective ecological risk assessment practices, and as such does not convey a credible understanding of potential ecological impacts associated with the spill and accident scenarios discussed in the assessment. The mitigation measures identified in the section that could reduce the risk of spills were not included in the calculations.

Missing Information Affects the Quality of the Assessment: The report is lacking critical information on regional hydrogeology, local hydrogeology, groundwater and surface water interaction. There are hundreds of references to groundwater in the report, and it is repeatedly listed as a key factor in fish habitat and other wildlife habitat functions. Appendix H refers to nearly 1,200 borings being made in the Pebble deposit, yet, hydrogeology within the pit and Tailings Storage Facilities (TSFs) is not described in the document. The Pebble EBD presents extensive regional and local studies conducted over multiple years which focus on water and geological resources in the watershed area. It appears that the Assessment did not utilize the environmental data presented in the EBD to attempt to address significant data gaps. This lack of any presentation of actual or likely groundwater conditions within the hypothetical mine scenario is a critical omission because of the repeatedly stated importance of groundwater.

Failure to Adequately Address Economic Effects: The Assessment presents a biased economic evaluation. While presenting the economic benefits of the ecological resources in Bristol Bay (pages ES-9), the report makes no such valuation of any mining economic benefits. The report states: "*These economic data provide background only." The economic effects of mining are not assessed*" (page ES-9). However, it does not justify the inclusion of benefit valuation of the ecological resources while at the same time excluding a benefit valuation of potential mining operations. While including a statement that revenues from a potential mine could range between $300 billion and $500 billion over the life of the mine (page 1-2), the Assessment fails to include other direct benefits to the local economy, such as employment, income, purchases from and payments to local vendors, and benefits to Native Alaskans. A recent economic study, authored by IHS Global Insight, dated May 2013, demonstrates a wide range of substantial economic impacts that the development of the Pebble deposit could provide to the State of Alaska demonstrating that it is possible to assess the economic effects of mining in the Bristol Bay watershed area. Other assumptions regarding mining operations are made throughout the report, but economic benefit assumptions are not included. The report appears to dismiss this contradiction by stating: "*This assessment is not an environmental impact assessment, an economic or social cost-benefit analysis, or an assessment of any one specific mine proposal.*"

Concluding Remarks

Concerned by the serious nature of the technical deficiencies identified by ENVIRON in EPA's original May 2012 draft Assessment, PLP contracted ENVIRON to review the April 2013 revised Assessment and to determine if the changes made to EPA's work corrected the many flaws identified in the original document and achieved the objectives set forth by the Agency to use the best available science and prepare an objective evaluation of possible future mining activities in the Bristol Bay watershed. The results of ENVIRON's work are summarized in Attachment A (herein) and presented in Attachment B, which examines each of the individual technical concerns highlighted to EPA during the first public comment period.

Based on the numerous fundamental defects identified in EPA's Assessment, ENVIRON has concluded that the entire work should be reevaluated in close consultation, cooperation, and involvement of all parties involved in the future of the Bristol Bay watershed. The current revised Assessment is not consistent with the principles of sound science, and continues to fail to meet the standards the EPA set for itself regarding both data quality and scientific rigor. Any efforts to proceed with this work should include, at a minimum, the preparation of a new draft Assessment for public comment and peer review after the fundamental defects identified by ENVIRON in Attachment A and B are remedied. Alternatively and given the likely prospects of further technical challenges in the current EPA approach, it is reasonable for the Agency to consider abandoning this flawed process and to allow the rigorous application of the Federal NEPA environmental review process and the Clean Water Act project permitting process to proceed for any potential mine development proposals in the Bristol Bay watershed.

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Attachment B – Technical Comments

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ORIGINAL DRAFT LOCATION			ORIGINAL COMMENT			COMMENTS REGARDING ADEQUACY OF RESPONSE IN SECOND DRAFT	
Page	**Section**	**Excerpt**	**Contributor**	**Response/Comment**	**Recommended Change**	**Addressed?**	**Comments**
15	Report Section Identification : Appendix A, Section 2.1, Page 15		State of Alaska	Comment: Snowpack is predominant source of water and there is a water surplus in the Nushagak-Big River Hills physiographic region, which is a "wet" climate class. Thus, downstream "dewatering" is less likely to be an issue. If permafrost moves up into stored waste rock, then less groundwater flow through it. Handling of snowpack and snow melt is important to impact assessment		No	Pg 3-1 The same language remains, indicating that the analysis is based on the questionable assumption that dewatering is an issue in a watershed with a wet climate classification.
4.37	Section 4.3.9.2, page 4-37 paragraphs 1 and 2		ENVIRON	These paragraphs need to be restated to reflect that all the information presented is assumed.		No	Pg 6-19 The paragraph remains essentially the same, and does not incorporate language that lets the reader know the stated situations are assumed scenarios created by EPA. Assumptions regarding project design and the lack of mitigation affect the entire analysis and tend to result in substantial overstatement of potential project effects.
2.2	Report Section Identification : 2.1		State of Alaska	Comment: This page shows that the Togiak, Naknek, Egegik and Ugashik watersheds are completely isolated from any of the mine drainages and could not be affected by the mine in any way yet nowhere in the text is this mentioned, especially when discussing the value of the fisheries, Native cultures, and direct impact to neighboring villages.	Recommended Change: The text in the executive Summary and in Chapter 2 should point out that these watersheds could not be affected by the mine and that they represent approximately xx% of the population of the Bristol Bay region and xx% of the economy.	No	Chapter 2 references these watersheds several times, but does not attempt to include the requested information. Since the analysis continues to use an incorrect spatial scale by incorporating watersheds that will not be impacted, the analysis is flawed.

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AI.12	Appendix I, p 12-13		ENVIRON	By author's admittance "existing research sheds relatively little light on the crucial subject of the impacts of road development on shallow groundwater and the connectivity to surface habitats important to fish". The following two quotes then go on to contradict one another: "the effect of the observed water table deformation on the down slope flux of groundwater remains unknown". and "the effects of water tabled deformation can project hundreds of meters from the road itself.		No	The language in Appendix I has not been changed to eliminate the inconsistency; therefore, the analysis rests upon conflicting information or assumptions about the extent of influence of roads on shallow groundwater.
3.6	Section 3.6		ENVIRON	The conceptual models use scenarios that the authors state may not actually occur, then they proceed to ignore this statement and apply all pathways and scenarios as if they are a forgone conclusion. The diagrams do not incorporate any avoidance, minimization or mitigative measures that are used in the mining industry to reduce or eliminate potential impacts to receptors, endpoints and sensitive resources. It appears that uncertainties and are ignored and therefore the model is suspect as to its validity and application to any mining efforts proposed in this watershed. The models do not address endpoints that the authors themselves formulated; that of genetic diversity.		No	Conceptual models have been simplified and redistributed but do not address specific mitigations; rationale given is it is not necessary, for the purpose of this assessment, to describe all mitigations. Box 4.1 suggestst they've been intrinsically included in the analysis but the analyses are unchanged. The assessment assumes a project design that would not be permittable under current state and Federal regulations. Therefore the analyses throughout the document tend to overstate the likely impacts of a project.

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	Report Section Identification: Chapter 6		State of Alaska	Comment: Since the performance of Failure Mode and Effects Analyses (FMEAs) and the requirement to implement risk mitigation measures to reduce risks is the practice in Alaska, and therefore Bristol Bay, the risk to salmon ecosystems should be included in the FMEA for any dam on a mine of any size or nature. If appropriately applied the risk to salmon ecosystem habitat should be addressed on a mine by mine and/or cumulative mines basis (for actual cases) and should ensure that only mines which meet the test of acceptable risk are permitted to be developed. If the mitigation measures required to render tolerable risks result in unfavorable project economics, then development of the mine would need considerable re-evaluation.		No	The comment has not been addressed. The assumptions regarding project design and mitigation continue to assume that the project would not meet state and Federal regulations. As a result, the analysis tends to overestimate likely project effects.

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ES.14—ES.22	Report Section Identification: Executive Summary		State of Alaska	Comment: Although EPA attempts to describe the mine in terms of no-failure, they do not mention this in terms of the probability that no failure will occur. Instead, EPA describes the impacts of a no failure operation, as well as the probabilities of failure and subsequent impacts from a catastrophic failure. EPA implies that failure is certain because tailings dams are "in place for hundreds to thousands of years." EPA does not describe the probability of the mine operating and closing without a major failure. If there is a probability of the occurrence of an event, Pe, then the probability of the event not occurring is 1-Pe. Consequently, for any low probability event, there is a complementary high probability that the event will not occur. For example, if the probability of a "failure" is 0.0001 per year, the probability for "success" (no failure) is 0.9999 per year; in other words, each year there is a 99.99% chance that no failure will occur.		No	Chapter 9 - the probability of a non-failure scenario is not emphasized, and the focus remains in this and other chapters on the potential for failures. As such, the risk analysis used in this assessment is biased.

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ES.16	Table ES-1 Summary of Probability and Consequences of Potential Failures	Failure Type: Tailings dam Probability: 10^4 to 10^6 per dam-year = recurrence frequency of 10,000 to 1 million years Consequences: More than 30 km of salmonid stream would be destroyed and more streams and rivers would have greatly degraded habitat for decades.	Knight Piesold	Statistics used to imply that failure is inevitable. This is based on a paper by Silva, Lambe and Marr who present a methodology to allow geotechnical engineers to evaluate 'tolerable risk'. They provide a specific example for a tailings dam where 'corporate management wanted to increase the level of safety of the fluid retention system to reduce the risk of release .... that could contaminate the pristine river downstream of the mine surface facilities.' They describe this method as a tool to justify increasingly conservative and more costly design solutions to reduce the risk to appropriate levels. Direct extension of the concepts in their paper would lead to the conclusion that the Pebble tailings dams would be designed and constructed to have an extremely low risk of failure. In effect they are indicating that if the consequences of failure are very high then the designs can be adjusted to ensure that the risk of failure is very low. Silva et al do not imply that this tool can be used to assign a probability of failure to a hypothetical structure that has not yet been designed.		No	Silva et al. (2008) is still used as the part of the failure assessment in Chapter 9; the reviewer's comment about the intent of this reference (i.e., should not be used to assign a probability of failure to a hypothetical structure that has not yet been designed) has not been addressed.

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ES.21 (43 of 339)	Report Section Identification : Vol 1 Executive summary		State of Alaska	Comment: Says: "Pre-Tertiary waste rocks, which would be excavated to expose the ore body, are acid-forming with high copper concentrations in test leachates and would require 2,900 to 52,000-fold dilution to achieve water quality criteria." These values need to be verified, see comment on page 5-49 through 5-55. For the biotic ligand model Pre-Tertiary waste rock leachates would require from 2,900- to 52,000-fold dilution. To meet State chronic water quality criterion the leachates would require from 280- to 580-fold dilution. The State has not conducted an evaluation as to whether the biotic ligand model is necessary to protect aquatic life nor has any state fully adopted this method for setting federally–required water quality standard statewide for copper. The biotic ligand model is particularly sensitive to low pH and low dissolved organic carbon values. Basing downstream risk solely on pre-Tertiary leachate does not consider the kinetics of acid generation and does not take into consideration the changes in pH and dissolved organic carbon that occur with downstream mixing or scouring (i.e., during a catastrophic dam failure) in the creek and in the lake. These relationships are non-linear. The use of the biotic ligand model results may well overly exaggerate the calculation of needed dilution for copper.	Recommended Change: Verify accuracy of values based on comment for pages 5-49 through 5-55. This statement should identify the physical and chemical mechanism assumptions and should, at a minimum, reflect State of Alaska Water Quality Standards for copper. Reference to the biotic ligand model for copper should be disclosed along with its sensitivity to low pH and low dissolved organic carbon.	No	The same estimates of CMC and CCC quotients are presented in the second external review draft in Tables 5-14, 5-15, and 5-16. Therefore, the comment stands: the results may well overly exaggerate the calculation of needed dilution for copper.

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3.5	Report Section Identification : 3.5 Types of Evidence and Inference		State of Alaska	Comment: The risk assessment approach using types of evidence and inference, conceptual modeling and characterization of risks by the lines (or multiple lines) of evidence is appropriate for generally understanding and scoping the watershed risk assessment. Higher risk (probability) failure or impact effects will likely require additional studies and numerical modeling to refine and better understand and quantify project risks and uncertainties.	Recommended Change: The study should outline what additional data, studies and numerical models would be appropriate to evaluate higher risk mine elements (i.e. tailings facilities failures), that would be appropriate to support a comprehensive watershed assessment and risk analysis, and will prepare agencies and lay the groundwork for future mine permit studies.	No	None of the risk assesments in the revised document (Chapters 7 through 11) specifically address additional data that would be required to address higher risk mine elements, conduct watershed assessments, or be required for future permitting. The document continues to focus on assumptions and extrapolations without demonstrating the need for further analysis.
4.26	4.3.7	Diversion of blocked streams upstream of the mine site.	Knight Piesold	Mining development occurs at the top of the watershed; diversions to upstream streams will be negligible. Where possible and needed, diversions will be incorporated.		No	The comment is addressed in Section 6.3.4; the installation of stormwater diversion structures in the operational phase is alluded to in the discussion of water diversion at closure in the last paragraph. However, the assessment of project impacts does not include mitigation measures that would reduce project effects. Therefore, the analysis overstates likely project effects.

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4.39	Section 4.4.1, page 4-39		ENVIRON	This section should acknowledge that the assumption that the TSF would be unlined except at the face may not be an accurate assumption.		No	Some consideration of liners is provided, with the assumption that they become less effective over time; however, effectiveness over time is directly affected by the final design characteristics of the liner system, the level of care and QA/QC protocols applied in liner construction, the management of the tailings facility in actual operation, the results of routine performance monitoring, and many other factors. The reviewer's point was that considerable uncertainty exists with respect to the actual design of there tailings facility, and such uncertainty should be acknowledged.
4.5	Report Section Identification : Chapter 4.2		State of Alaska	Comment: EPA states that the Bristol Bay watershed encompasses 23,539 square miles, and loosely describes existing infrastructure in the region. EPA fails to compare the area of the mine scenarios as a percentage of the total area. Based on the surface areas for the minimum and maximum mine scenarios listed in Table 4-3 (and assuming the total transportation corridor is 0.25 kilometers wide), the areas of development are approximately 0.1% and 0.2% of the total area of the watershed, respectively. Note that the minimum mine size would be a very large mine on a global scale.		No	The comment has not been addressed leaving the reader with no context regarding areal effects in the affected basins.

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5.13	Report Section Identification : Box 5.1		State of Alaska	Comment: NWI wetland mapping is based on aerial photo interpretation that is large scale and is not accurate at the scale being used here, particularly for road impacts. Also, NWI data is often 20 to 30 years old. Therefore, while it is appropriate for a large scale screening, it is not acceptable for predicting site-specific impacts without a large potential for error. It is a bit confusing, but it seems 100 meters along rivers and 200 meters along NWI wetlands were set aside as buffers. If the roadway in the mine site passed within these buffers, a hydrological impact was tallied. In addition the road impacts were based on a 200 ft wide road corridor, while "direct fill" was based on a 9.1 m wide roadway. These buffers are quite large and likely overestimate the hydrological impact. This overestimation offsets at least a portion of the purported "conservative" estimate resulting from inaccurate stream and fish presence maps.	Recommended Change: Most regulatory wetland and river buffers are equal to or less than 150 feet. Reducing the buffer to this more accurate area of "impact" would produce a more accurate estimate of impacts to wetlands and rivers along the road corridor.	No	There was additional description of how the buffers were derived, but they were not changed in the analysis. For example, the 200-m road buffer was derived from Forman 2000 (page 10-14). There was no change in the use of NWI data to calculate affected area for wetlands. Therefore, the analysis likely continues to overestimate impacts.
6.36	Report Section Identification : 6.3		State of Alaska	Comment: The topic of this section is unclear whether the assumptions provided are adequate and/or provide reasonable estimates of potential risk for very long term effects.	Recommended Change: A more site specific analysis of water balance and treatment/collection failure needs to be completed for likely mine conditions and operations.	No	No consideration of the exposure durations (other than constant) is presented in this current review draft.

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Starting on 5.21	Report Section Identification : 5.2.2 Effects of Downstream Flow Changes		State of Alaska	Comment: There has obviously been some thought put into the potential changes in flow around any potential mine site. At this point, this examination can only be theoretical, but putting it in the assessment document makes it seem like the worst possible outcome. The interactions of the ground and surface water hydrology in that area are extremely complex. The uncertainty of the impacts from any disturbance should be emphasized. The importance of the surface and subsurface flow to spawning and rearing salmon cannot be understated. The theoretical treatment of this in the assessment suggests it can predict a possible outcome that in actuality cannot be predicted.	Recommended Change: Explicitly state the theoretical nature of these possible outcomes and emphasize the uncertainty.	No	Section 5.2.2 Effects of Downstream Flow Change. The uncertainty of the estimations has been noted in several subsections; however the analysis continues to rely upon assumptions that lack references, and incorporates the term 'would' in a manner that suggests the potential for occurrence.

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4.1	Report Section Identification: Volume 1 Chapter 4 Mining Background and Scenario and 4.3.3 Mine Operations, and 4.3.9.1 Transportation Corridor Roads		State of Alaska	Comment: "Described mining practices and our mine scenario reflect the current practice for porphyry copper mining around the world, and represent current good, but not necessarily best, mining practices. " "Based on standard mining practices, we assume that drill and blast methods would be used to excavate the rock, at a processing rate of approximately 200,000 metric tons/day for both the minimum and maximum mine sizes (Table 4-3)." "Material sources for road embankment fill, road topping, and riprap would be available at regular intervals along the road route, and we assume standard practices for design, construction, and operation of the road infrastructure, including design of bridges and culverts for fish passage." Why are standard but not best practices assumed in the scenario? It is reasonable to assert that practices better than current best practices will be in place for any mine development in the region given the advances in technology and engineering that are likely between now and the date of construction and actual mining.		No	Text still states on page 6-3 that "We specify that all mine components would be developed using modern conventional design and practice and operated under standard industry practices. Our purpose in this assessment is to evaluate the potential effects of mining porphyry copper deposits in the Nushagak and Kvichak River watersheds given design and operation to these standards." The reviewer's point on use of best practices is a good one, and has not been satisfactorily addressed. Given the extraordinary level of controversy and scrutiny associated with mining projects proposed in this watershed, it is also highly arguable that no project could ever be permitted if the State of Alaska were not convinced that the practices represented in the mine design adequately addressed potential risks and did not employ best practices that have been proven though prior experience with similar relevant mining scenarios, or from credible, well-documented feasibility studies and testing programs conducted by knowledgeable professionals. Additionally, in order to maintain viable access to mineral resources, modern mine operators, certainly most major international operators, are driven towards the adoption of best practices by their own corporate policies, the conditions established by major lenders (e.g., International Finance Corporation, or the 75+ major private banks who have adopted the Equator Principles), jurisdictional permitting requirements, and other important factors. Designing

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4.11	Report Section Identification : Chapter 4.2.3		State of Alaska	• Comment: EPA states, "...geomembrane technology has not been available long enough to know their service life..." and generally discounts the potential mitigation value of the product. In fact, the advent of geomembranes began in 1839 when Charles Goodyear vulcanized natural rubber with sulfur which led to the development of thermoset polymers. Polyvinyl chloride resin production began in 1939 and mass production of polyethylene compounds began in 1943. The U. S. Bureau of Reclamation began using geomembranes in the 1960s. The geosynthetics industry broadly shifted to thermoplastic polymers in the 1980s. HDPE and other formulations of polyethylene are routinely approved by EPA and other international regulatory agencies for use in solid and hazardous waste landfills around the world (which have indefinite design lives, also). (Reference: Designing with Geosynthetics, 5th Edition. Koerner, 2005 ISBN-10: 0131454153)		No	Current text still states on page 4-17 that "However, geomembrane technology has not been available long enough to know the service life of these liners", and still concludes that geomembranes liners can fail based on their review of (Koerner et al. 2011). Geomembrane liners are widely and successfully used in the mining and waste management industry, and in our experience, the incorporation of membranes into multi-component composite liner design approaches for tailings facilities is increasingly sophisticated. The probability of the failure of the geomembrane component of a liner system is greatly reduced with the level of care taken in the design and preparation of underlayment, the actual deployment and thermal welding of liner material, and in the testing regime used to ensure the integrity of the weld bonds. The reduction of the probability of liner failure or the significance of any areas of leakage by the routine application of appropriate QA/QC methodologies during liner construction has not been addressed in this Section. The text also presents seepage collection as an option "if seepage collection is expected or observed." Rockfill tailings dams are usually designed to seep as an operational safety measure, since lowering the phreatic pressure within the tailings mass tends to reduce physical stresses on the dam structure. It would be highly unusual to see a modern rock fill dam design that did not provide for some collection of seepage and pumpback to the tailings supernatant or reclaim

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4.12	Report Section Identification : Chapter 4.2.3		State of Alaska	Comment: EPA describes basic concepts of tailings dams as shown in Figure 4-5. This is an elementary level drawing with no technical merit.		No	This figure has not been changed, and is presented as Figure 4-4, on page 4-17 of the second external review draft. As the reviewer suggests, the figure is extremely simplistic and does not present viable hybrid options (e.g., downstream with final centerline raises).
4.13	Report Section Identification : Chapter 4.3		State of Alaska	Comment: The mine scenarios assessed by the EPA are representative of a very, large scale mining with a particular set of mine development elements that are not representative of a large percentage of porphyry copper deposit mines. For example, an open pit mine is selected while there are a number of large scale mines of such deposits that mine by bulk underground methods such as block caving, sub-level caving vertical crater retreat and other underground methods. The volume of waste rock created by such underground mining methods is several orders of magnitude less than that assumed in the EPA mine scenarios.		No	While block caving is discussed in Chapter 4 as a potential extraction method for porphyry copper deposits, the current draft of the EPA document retains a focus on the same type of large-scale, open pit mine scenarios considered in the first draft. The reviewer's comment on the potential applicability of block caving methods and the associated potential environmental benefits is not addressed. The current draft of the EPA report only assumes three large open-pit scenarios - Pebble 0.2, Pebble 2.0, and Pebble 6.5 - that vary in relation to the theoretical amount of ore to be mined. Whether or not these scenarios would resemble the actual design of a mining project as presented in the State of Alaska's permitting process is a matter of conjecture. Failure to incorporate a range of realistic possibly scenarios biases the analysis.

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4.13	Report Section Identification : Chapter 4.3		State of Alaska	Comment: The tailings disposal method by hydraulically placed, slurry tailings is one of a number of methods that can be considered. While it is the most favored of the disposal methods for cost, there is an increasing tendency to adopt alternative methods such as paste and filtered, dry stacked tailings that effectively address water management issues and environmental protection. Paste tailings technology is being applied at large scale porphyry copper mines such as the Esperanza mine in Chile. These alternative tailings disposal methods permit greater freedom for the selection of disposal facilities and can be used to address specific environmental concerns. For example, with a smaller footprint, the need to build a cross valley dam can be eliminated, along with impacts to stream flow and salmon habitat. By selecting a tailings disposal method that requires the tailings storage facility in a location where the stream impact is maximized, the Assessment results in environmental impacts greater than can be achieved by alternative methods.		No	No consideration is given in the current Bristol Bay Assessment to any types of tailings disposal methods other than a tailings pond based on slurry transfers in a location requiring a cross-valley dam. The reviewer is correct in the observation that there are a number of viable alternatives that would normally be considered in the siting and design of a tailings facility for an actual mine. The analysis assumes one approach only and does not address alternate approaches that may reduce risk. It is expected that alternate approaches will be evaluated during the permitting process. The analysis need to incorporate alternative approaches into the assumed or alternative project design. Failure to do so results in an assessment that overestimates likely project effects.

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4.17	Report Section Identification : 4.3 Mine Failure Scenario		State of Alaska	Comment: The No Failure impact and effects scenario is likely overly conservative. Full containment and failure-free mining are not likely mine scenarios. Also, combining cumulative risks from the Failure scenario is not likely either. The risk analysis method used in the assessment describes the conceptual model framework identifying an envelope of potential risks, but does not quantify the risks to any degree of certainty. The risk assessment should seek to evaluate risks (and quantify where feasible) and identify the mostly likely mine development and failure scenarios to understand likely impacts, while stating the range of knowable risks.	Recommended Change: Risk should be quantified, and estimated, where feasible (i.e. mine site footprint impacts, hydrologic impacts, dam failure) on elements of the study where this is feasible, and for items where calculation of risks and effects are unfeasible, scale of risk should be assigned (i.e. high probability and small area or low impact). A probabilistic risk based analysis of a likely mine operation and failure scenario would reduce uncertainties leading to underestimates and overestimates of stated risks and impacts.	No	Chapter 9, "Tailing Dam Failure" has an expanded treatment of the probability of tailing dam failures, and discussion of uncertainties, but does not include evidence of the suggested probabilistic risk analysis. In addition, in the absence of a specific mine profile to evaluate, this section still basically presents a catastrophic failure of the largest Tailing Storage Facility in order to determine the number of miles of stream that could be impacted. As such, the complete intent of the recommended changes has not been met and the document does not adequately assess the risk of failure nor the risk of consequences of a failure.
4.21	Section 4.3.5, Page 4-21, Paragraph 2		ENVIRON	The paragraph states that it was assumed that the TSF would be unlined other than on the upstream dam face, and there would be no impermeable barrier constructed between tailings and underlying groundwater. Generally, unlined TSF are not permitted if there is potential for significant degradation of the underlying groundwater.		No	The second version continues to state that "The TSF would be unlined other than on the upstream dam face, and there would be no impermeable barrier constructed between tailings and underlying groundwater." Again, this is an unrealistic assumption for any tailings facility constructed in this watershed and subject to the permitting process currently required by the State of Alaska. These assumptions result in overestimates of potential project effects that permeate throughout the document.

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4.23	Report Section Identification: Chapter 4.3.6		State of Alaska	Comment: In Section 4.3.6, waste rock disposal areas are described without a specific description of the basis for the estimated size or footprint, apart from stating "these piles will be constructed with a geometry designed to reduce the amount of runoff requiring treatment."		No	No discussion is provided that explains how the footprints of the waste rock stockpiles were estimated. Section 6.3.3 ("Waste Rock") in the revised document has significantly reduced detail with respect to the discussion in Section 4.3.6 ("Waste Rock") in the original document. This discussion is therefore based upon unsubstantiated evidence.
4.33	Report Section Identification: 4.3.8.5 Premature Closure		State of Alaska	Comment: Premature mine closure is discussed. There are two sentences that need additional discussion. First "In one study of international mine closures between 1981 and 2009, 75% of the mines considered were closed before the mine plan was fully implemented (Laurence 2011)." Second, later in the section states "Because premature closure is an unanticipated event, water treatment systems would likely be insufficient to treat the excessive and persistent volume of low pH water containing high metal concentrations." If the premise of a high rate of premature closure is true as presented in the assessment, it would be reasonable for the authors to assume premature closure as a likely scenario and the study should include this consideration in the No-Fail scenario or likely scenario analyses.	Recommended Change: Include an expanded discussion of premature closure, the uncertainty, and the potential impacts on fisheries and indigenous cultures as this condition is likely to occur.	No	No expanded discussion has been added as recommended by the reviewer. Therefore, statements made about premature closure without benefit of additional analysis remain unsubstantiated.
4.36	Section 4.3.9.2, 1st paragraph, 1st sentence		ENVIRON	This needs to be restated as an assumption.		No	same statement in Section 6.1.3.2

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4.39	Report Section Identification : Chapter 4.4.2		State of Alaska	Comment: EPA states, "A tailings dam failures occurs when a tailings dam loses its structural integrity and releases tailings material from the impoundment. The released tailings flow under the force of gravity as a fast-moving flood containing a dense mixture of solids and liquids, often with catastrophic results." EPA lists examples of such catastrophic failures in Box 4-4. EPA then describes failure mechanisms such as overtopping and slope instability and then discusses failure statistics. However, EPA fails to point out that the failure statistics as presented do not distinguish catastrophic failures from relatively inconsequential incidents, thus implying that the failure probabilities are applicable to the uncontrolled release of tailings or otherwise catastrophic failures.		No	The document has not been clarified with respect to the uncertainty introduced by not distinguishing between catastrophic failures and relatively inconsequential incidents. Not all releases from tailings facilities are catastrophic events, but the report does not acknowledge the likelihood of release scenarios ranging from the inconsequential to the catastrophic. Therefore, the document fails to adequately address risk and tends to overstate impacts.
4.4	Section 4.4.2.1		ENVIRON	All of these causes of failure can be avoided through proper design of the project. They should not be assumed. Rather, the document should assume that the mine design will appropriately address the potential for dam failure.		No	While the document states that no record of large dam failure is available, the analysis continues to represent the consequence of a catastrophic release of tailings from a dam failure without any downward adjustment of probability due to the application of best design and management practices and an exacting permitting process. The reality is, no large dam can our would be constructed without significant engineering, construction management, QA/QC, and operation controls being in place, all of which would be submit to review and approval as part of the permitting process.

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4.4	Report Section Identification : 4		State of Alaska	Comment: Considerable narrative is presented on the hypothetical chemistry of the porphyry copper deposits, discussing how the acid generation potential (AP), the net neutralization potential (NP) and the neutralizing potential ratio (NPP) are calculated and what they mean. On page 4-5, it is stated that "In general, the rocks associated with porphyry copper deposits tend to straddle the boundary between being net acidic and net alkaline, as illustrated by Borden (2003) for the Bingham Canyon, Utah porphyry copper deposit (Figures 4-2 and 4-3). This is good information but the specific AP, NP and NPP of the Pebble Deposit are not discussed here. This is crucial information since it has bearing on potential environmental impacts during the mine and after the mine life in perpetuity. Good information on the humidity cell tests of the Tertiary and Pre-Tertiary waste rocks are included in Table 4 on page 15 of Appendix H. This information is more valuable than the extensive hypothetical discussion and should be incorporated into pages 4-4 through 4-7.	Recommended Change: Place the information from Appendix H (in summary form) on pages 4-4 through 4-7.	No	This comment is not reflected in the current review draft. Subsequently, the analysis in this section remains based upon hypothetical data and likely is not reflective of actual expected effects.

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6.14	Report Section Identification : Chapter 6.1.4.1		State of Alaska	Comment: Box 6-1 uses case histories to extrapolate the impacts of tailings to the current study. However, all three examples are historical mines initially developed in the 1800s that are now Superfund sites. None of the examples would have had tailings dams or mill processes based on current geotechnical, metallurgical and environmental engineering principles or current regulatory standards. EPA states, "These brief descriptions provide background information and support the use of evidence from these cases in analyzing risks from a hypothetical tailings dam failure in the Bristol Bay watershed". The descriptions of three sites which had typical/historic operations which occurred decades ago does not support an "analogous" relationship with what "may" occur at the Pebble site. For instance it is hard to compare mining in the Coeur d'Alene River where "tailings were dumped into gullies, streams, and the river until dams and tailings impoundments were built beginning in 1901", with a modern mining facility designed and permitted under much more stringent regulations than existed over a decade ago. Similarly, analysis of a tailings dam failure in 1950 at Soda Butte Creek in Montana and Wyoming is hardly an analogous situation to what may occur in the Bristol Bay region.		No	The same level of analysis and use of these sites as analogous to the Pebble site is presented in the current review draft. This draft states that "*Although these cases are highly uncertain sources of information concerning the potential toxicity of spilled tailings, they can be used with confidence to identify or confirm important modes of exposure and the processes leading to exposure. They also confidently demonstrate the persistence of tailings and the leaching of their metals for multiple decades.*" The comparison with sites developed over 100 years ago is inappropriate. Standards and regulations have changed remarkably since those mines were developed. All comparisons with sites that were not developed to modern standards need to be removed. They are misleading and tend to give the reader a sense that project impacts would be much larger than would actually occur in today's regulatory environment.

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6.14	Report Section Identification : Box 6.2		State of Alaska	Comment: The examples provided in the assessment, such as Soda Butte Creek should be noted that much of the damage is the result of mining practices of the late 1800 and early 1900s, and related to acid mine drainage mobilization of metals. These issues may not apply as directly to the Pebble Mine under currently regulatory permitting and oversight conditions.	Recommended Change: Provide an analysis of the examples, comparing them with the proposed mine, identifying conditions that are most relevant to the Pebble Mine.	No	The same level of analysis and use of these sites as analogous to the Pebble site is presented in the current review draft. This draft states that "Although these cases are highly uncertain sources of information concerning the potential toxicity of spilled tailings, they can be used with confidence to identify or confirm important modes of exposure and the processes leading to exposure. They also confidently demonstrate the persistence of tailings and the leaching of their metals for multiple decades." The comparison with sites developed over 100 years ago is inappropriate. Standards and regulations have changed remarkably since those mines were developed. All comparisons with sites that were not developed to modern standards need to be removed. They are misleading and tend to give the reader a sense that project impacts would be much larger than would actually occur in today's regulatory environment.

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6.15	Box 6-2 / 6-15	Box 6-2 / 6-15 = The Nixon Fork Mine is an underground gold mine that was intermittently mined between 1917 and 1950. The modern mine opened in 1995 then closed in 1999 (ADNR 2012) and reopened under new ownership again in 2007. The current operation is mining two ore bodies with a defined resource of 241,966 metric tons (266,755 tons) of ore containing an estimated 4.6 million grams (162,550 ounces) of gold (ADED 2012). An additional 856,156 grams (30,200 ounces) of gold is estimated to be recovered by reprocessing tailings on site. The mine is located on federal lands managed by the Bureau of Land Management. The mine operates under authorizations from the Bureau of Land Management, Alaska Departments of Natural Resources (ADNR) and Alaska Department of Environmental Conservation (ADEC). Below is the chronology of events described by	Knight Piesold	Need to review what EPA is trying to imply with these examples??? Need to re-iterate positive aspects of Fort Knox and Gibralter and indicate the incident at Nixon Fork is not relevant to Pebble.		No	This comment is not reflected in the current review draft. The comparisons to the Nixon Fork mine are not relevant .

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7.1	Report Section Identification : 7.0		State of Alaska	Comment: Cumulative impacts are a potential concern, and the development of infrastructure for the Pebble Mine does make it more likely for other roads and infrastructure. However, assessing the impacts of these extremely hypothetical mines is even more difficult than for the Pebble Mine deposit. It would seem to be important to better predict the risks from the Pebble Mine before cumulative effects are examined.		No	Cumulative effects continue to be a significant part of the revised document regardless of the veracity of the information used.
7.2	Section 7, page 7-2, Box 7-1		Environ	The authors conclude that "the diverse and relatively intensive development makes the Fraser River watershed a poor analogue for the development of mines in the nearly pristine Bristol Bay watershed." Box 7-1 appears to contradict the report's basic premise expressed in Section 1 (Introduction) that a comparison will be made in the report between the Fraser River watershed and the Bristol Bay watershed.		No	This text box is still included with essentially the same wording in the current draft as Box 8-4. The analysis therefore continues to incorporate conflicting and potentially inapplicable information.

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	Report Section Identification : Chapter 4		State of Alaska	Comment: EPA mine scenarios consider minimum and maximum sized mines. In terms of mined ore/tailings disposal volumes those boundaries are 2 billion metric tons (tonnes) and 6.5 billion tonnes, respectively. At 2 billion tonnes, the minimum mine scenario would be considered a very large mine on a global scale, and exaggerates the respective potential impacts under normal operations and failure scenarios. There are probably less than 10 mines in the world with estimates of 2 billion tonnes or more of tailings. The Andina Mine in Chile is the only mine known to be studying the concept of storing 5.8 billion tonnes of tailings. There are currently no metal mines with tailings storage facilities of this magnitude.		No	The current analysis uses three scenarios - Pebble 0.2, Pebble 2.0 and Pebble 6.5 - reflecting the amount of ore to be mined. All of these ore reserves are still extremely large in comparison with other current reserves world wide. The three scenarios fail to bracket a reasonably range of mine sizes. The effect of this is that the range of impacts depicted in the document tends to be larger than would actually be expected.
	Report Section Identification : Chapter 4		State of Alaska	Comment: It is difficult to make technical observations regarding the mine development model used in the Assessment because the basis of the model is comprised of a number of assumptions and not real data. While the proposed mine and scenarios that were assumed by the EPA may appear to be realistic in a sense, based on a given set of conditions, they by no means represent the only options and outcomes that could apply to a mine located in the Bristol Bay area, or any mine that is in the planning, development, operational or closure stages.		No	Two additional mine scenarios have been added to the analysis, but all rely to some extent upon theoretical data. The mine scenarios generally fail to incorporate expected requirements of state and Federal agencies and therefore tend to indicate impacts greater than would be allowed under current regulations.

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	Report Section Identification: Chapter 5, 6, 7 and 8		State of Alaska	Comment: EPA fails to consider reclamation and closure scenarios where mines have successfully operated and closed without major, adverse environmental impacts. No potentials of success for wildlife/mining coexistence, wildlife habitat enhancement, or adaptable species such as sheep and fish incursions into active mining areas. For example, the Fort Knox Mine and the Red Dog Mine are the locations of the two of the most productive grayling habitats in the state. A Dall sheep ram has taken up residence on the organic stockpile from the Walter Creek Heap Leach Pad construction at the Fort Knox Mine. Exploration operations at the Pebble prospect were recently delayed because of migratory song bird nesting in a drill rig.		No	No discussion or reference to other mining examples with respect to wildlife in Chapters 12, 13 & 14. Because the document fails to address the comment, the document overstates expected impacts on wildlife.

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19, 20 and 21	Report Section Identification: Appendix H		State of Alaska	Comment: The following comment is an example of how could significantly alter the conclusions of impact if the mine plan used in the assessment had been vetted through the environmental and permitting review processes. There are actual humidity cell test results for the Pebble tailings, which were started in 2005 and 2008; however, it appears that these tailings are the rougher tails (85% of the total) and not the pyritic tails (14% of the total). Table 7 on page 21 shows pH average of 7.8 for the rougher tails. No specific data is presented for the pyritic tails. It is likely that these tails are extremely acidic due to: a) a fine size of 80% passing 30 µmeters, and b) the pyrite content will range from 50% to 80% of these tails. This information came from the Northern Dynasty Minerals, Ltd. 2011 Waldrop report. The applicant may state that the acid producing potential of the pyritic tails are irrelevant since they plan to encapsulate them in the TSFs with inert rougher tails and the combination of these tails and a large water height will prevent the pyritic tails from oxidizing. It is still important to know what the potential is of the pyritic tails to produce acid, since the worst case is that these tails may oxidize.	Recommended Change: Get SPLP and/or humidity cell tests on the pyritic tails and evaluate the results. Comment Reference: Northern Dynasty Minerals "Preliminary Assessment of the Pebble Project Southwest Alaska" issued on February 17, 2011, by Wardrop, a Tetra Tech Company, pages 49, 50 and 409	No	No additional analytical data for pyritic tails was provided; Appendix H in the second version of the document is identical to the first. Comment stands.

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ES.15 to ES.18	Executive Summary Tailings Dam Failure	The range of estimated probabilities of dam failure is wide, reflecting the great uncertainty concerning such failures. The most straightforward method of estimating the annual probability of failure of a tailings dam is to use the historical failure rate of similar dams. Three reviews of tailings dam failures produced an average rate of approximately 1 failure per 2,000 dam years, or 5 x 10-4 failures per dam year. The argument against this approach is that it does not fully reflect current engineering practice. Some studies suggest that improved design, construction, and monitoring practices can reduce the failure rate by an order of magnitude or more, resulting in an estimated failure probability within our assumed range.	Knight Piesold	The author clearly states a review of 'similar dams', however similar in this sense refers to 'all tailings dams' and includes tailings dams constructed by the upstream construction method. This is incorrect and misleading. Failure Probability has been extrapolated from a data set that is not relevant to any realistic proposal for development of a tailings dam at the Pebble site. This is also discussed in KP Whitepaper 1.		No	The current analysis (Section 9) appears to be based on essentially the same level of historical analysis as was presented in first review draft of the EPA document; no response has been made to address the reviewers comment on the actual relevance of this data set. The dams used to compare potential impacts need to be carefully selected to reflect modern construction standards and typical mitigation requirements. The comparisons lead the reader to assume that impacts of sites constructed using out-moded approaches would be expected at a new site. The analysis is therefore misleading.

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Page	**Section**	**Excerpt**	**Contributor**	**Response/Comment**	**Recommended Change**	**Addressed?**	**Comments**
i	Report Section Identification : Abstract – and Elsewhere in the Document		State of Alaska	Comment: The document states that the hypothetical scenarios used would "result in the direct lossof 87.5 km to 141.4 km of streams and 10.3 and 17.3 km2 of wetlands." This does not adequately put the projected impact in perspective because there is no attempt to relate this to a percentage of the entire watershed. An abstract should be an overview or big picture and in this case the big picture is the entire Bristol Bay Watershed.	Recommended Change: Express the hypothetical stream and wetlands loss as a percentage of the entire Watershed.	No	The use of watershed-wide comparisons has not been incorporated into the revised document. The document fails to use the appropriate scales when relating the size of impacts. Because of this, the document fails to adequately represent the overall effects and is biased towards maximizing perceived impacts.
4.38	Section 4.4, p.4-38, Box 4-3		ENVIRON	The overall intent of this box is not clear and seemingly contradictory. The summary in box 4-3 describes local faults (near Lake Clark and in the Iliamna Lake) and the known activity on those faults, indicating that activity on major faults has been minimal and that smaller faults in the area have "very limited capability to produce damaging earthquakes". However, the next paragraph discusses, in general terms, unpredictable "floating earthquakes" and stress induced earthquakes. Then, the conclusion highlights that in the Bristol Bay area there is a significant amount of uncertainty in (1) interpreting seismicity (i.e., the general frequency and distribution of earthquakes) and (2) identifying fault locations and extents.	International Oil and Gas producers (OGP). 2010. Risk Assessment Data Directory, Riser & pipeline release frequencies. Report No. 434-4. March.	No	Discussion is now part of the text but remains essentially unchanged. It continues to be contradictory. The risk of earthquakes in the project area are not accurately depicted.

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Page	**Section**	**Excerpt**	**Contributor**	**Response/Comment**	**Recommended Change**	**Addressed?**	**Comments**
4.38	Box 4-3	Interpreting the seismicity in the Bristol Bay area is difficult because of the remoteness of the area for study, lack of historical records on seismicity, and complex bedrock geology that is overlain by multiple episodes of glacial activity. Thus, there is a high degree of uncertainty in determining the location and extent of faults, their capability to produce earthquakes, whether these or other geologic features have been the source of past earthquakes, and whether they have a realistic potential for producing future earthquakes.	Knight Piesold	The summary discounts the previously stated studies, and illustrates a seeming tendency to discount the science that doesn't suit the biased perspective that is promoted in many areas of the EPA document.		No	Pg 3.35 paragraph 3 - The same statements have been retained.

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Page	**Section**	**Excerpt**	**Contributor**	**Response/Comment**	**Recommended Change**	**Addressed?**	**Comments**
4.44	Section 4.4.2.1, p. 4-44 (PDF p.133)		Environ	This table is very short, and based on the data in Figure 4-11 (p. 4-42 [PDF p.131]), does not include the 5.1 to 6.0 magnitude earthquakes to the north and south of the Pebble Deposit location. Based on the context in which this table is cited through section 4, the purpose of this table seems to be to show the range of earthquakes that can occur in Alaska as well as in the Lake Clark area. Although there is a note at the bottom of the table indicating that smaller earthquakes do occur in the Lake Clark area (near the Pebble Deposit site), it may be useful to list a few of these earthquake events through time to make this point more clear. Otherwise, this table only shows large earthquakes relatively far away from the site, which is misleading. It would also be helpful to include the 5.1 to 6 magnitude earthquakes to the north and south of the Pebble Deposit location.		No	The same table remains in Chapter 3, and therefore continues to contribute to fundamental bias in the analysis.
4.62	Section 4.4.4, 2nd paragraph		Environ	In the past decade, substantial changes in requirements for culvert design have been adopted across the country in response to studies documenting passage barriers and culvert failures. This document must assume that the current standards for culvert design and placement will be implemented. Failure rates of culverts that do not meet current standards are not applicable in this document. This section should include a discussion of the current standards and the expected failure rate of culverts installed using current standards.		No	Chapter 10. Current standards in culvert construction are not addressed. The analysis is therefore inaccurate as it appears to ignore recent changes in technology and expectation that have greatly improved culvert function. Therefore, the analysis overstates likely impacts.

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Page	**Section**	**Excerpt**	**Contributor**	**Response/Comment**	**Recommended Change**	**Addressed?**	**Comments**
4.8	Report Section Identification : 4		State of Alaska	Comment: The following comment is an example of how possible mitigation methods could reduce the level of environmental concern and significantly alter the conclusions of impact if the mine plan used in the assessment had been vetted through the environmental and permitting review processes. The referenced pages discuss the processing operation, but only in brief detail. The Northern Dynasty Minerals, Ltd. Report of 2011 was used to supplement this information. The accuracy of this report in representing PLP current plans is unknown, but this report does provide details and specifics that would be expected from a submitted mining project proposal. From pages 4-8 through 4-11 and pages 164 through 174 in the Northern Dynasty Minerals, Ltd. Report of 2011, a prospective plan is to grind the ore to 80% passing 200 µmeters and produce rougher tailings which are basically inert and are approximately 85% of the total ore feed. The remaining 15% goes to another grinding circuit where the material will be ground to 80% passing 30 µmeters. There will then be various recovery flotation units for copper, molybdenum, etc. Gold will also be recovered. Of the 15% that is reground, 14% will be pyritic tailings that will be over 50% to 80% pure pyrite. This material will be encapsulated in the TSFs to prevent (or retard) oxidation and thus the production of sulfuric acid and dissolution of metals. As a potential mitigation measure, PLP should consider modifying the processing mill to get full recovery of the pyrite and place none of it in the TSFs. It is fully recognized that this major change would require a full evaluation but it is based on the following reasons: 1) Page 173 of the Northern Dynasty Minerals, Ltd. report shows that considerable gold is locked up in		No	No consideration or evaluation of this scenario is provided in the second external review draft. The comment stands. This is yet another example of assumptions made regarding the project design that do not include reasonble mitigation measures. Failure to define a project that could reasonably be permitted affects the quality of the entire assessment. Impacts are overstated throughout the document due to assumptions regarding design and lack of mitigation.

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Page	**Section**	**Excerpt**	**Contributor**	**Response/Comment**	**Recommended Change**	**Addressed?**	**Comments**
4.9	Report Section Identification : 4		State of Alaska	Comment: The following comment is an example of how possible mitigation methods could reduce the level of environmental concern and significantly alter the conclusions of impact if the mine plan used in the assessment had been vetted through the environmental and permitting review processes. The Simplified Schematic of Mined Material Processing does not separate the waste rock into PAG waste rock and NAG waste rock. This is important since the PAG waste rock can have impacts on the environment if not placed properly and if considerable acid formation occurs. The Northern Dynasty Minerals, Ltd. 2011 report states that the PAG waste rock will be piled on the west side of the pit and will be processed at the end of the mining operations and the tailings will be placed in the mine pit. If the price of copper drops, it may not be economically feasible to run this material through the mill at that time (it is low grade ore). This possibility must be addressed for long term post-closure, particularly with regard to water capture and treatment. If the material is strongly PAG, it should not be allowed to place this material in the mine pit since it will potentially affect groundwater in the area for a very long time if not treated. Also, full capture and treatment could be difficult in the long term. Table 4 of Appendix H shows that the Pebble East Pre-Tertiary waste rock humidity cell tests result is an average pH of 4.8.	Recommended Change: Revise the Schematic to include PAG and NAG waste rock. According to Northern Dynasty Minerals, Ltd., the 25 year plan would produce 2.4 billion tons of NAG and 0.6 billion tons of PAG. Include more discussion on possible impacts of leaving the PAG waste in permanent piles and in the mine pit, assuming that no future processing is undertaken. Comment Reference: Northern Dynasty Minerals "Preliminary Assessment of the Pebble Project Southwest Alaska" issued on February 17, 2011, by Wardrop, a Tetra Tech Company, page 49.	No	The requested modifications were not made in the revised draft document. The comment stands. This is yet another example of assumptions made regarding the project design that do not include reasonable mitigation measures. Failure to define a project that could reasonably be permitted affects the quality of the entire document.

EPA-7609-0003748_0039

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Page	**Section**	**Excerpt**	**Contributor**	**Response/Comment**	**Recommended Change**	**Addressed?**	**Comments**
5.1	Report Section Identification : 5.1 Fish Distribution		State of Alaska	Comment: In regard to standard risk assessment format, descriptive sections such as 5.1 Fish Distribution are usually part of Problem Formulation. As commented above, and again related to risk assessment format, the actual Problem Formulation section is too general and sections 2, 3, and portions of 4, 5, and 6 provide more specific analysis that could be made part of problem formulation. The purpose being to focus the conceptual models and risk assessment on critical issues. This does get done to some extent, but just not in the problem formulation. The Bristol Bay Watershed Assessment as a whole does not follow a typical risk assessment format. Rather, individual sections are each generally formatted each as their own risk assessments.	Recommended Change: Section 5-1 applies to multiple sections of the report and should be moved to the Problem Formulation section of the report, to augment the very general information currently provided. Alternatively, make a specific problem formulation part of each of Sections 5 and 6, keeping a general conceptual model in Section 3 related to potential impacts, and then refine that broad conceptual model with a conceptual exposure model that better fits the scenarios in each of Sections. Problem Formulation is supposed to focus the assessment on the most important endpoints requiring assessment or investigation. As it is written there is this long laundry list of potential endpoints scattered throughout Sections 2, 3, and 4. The Risk Assessment portions need focus.	No	Although Problem Formulation was expanded into 5 chapters, which included an expanded discussion of fish distribution and abundance in Section 5.2: "Endpoint 1: Salmon and Other Fishes," the same information from Section 5.1 was moved to Risk Analysis and Characterization, and is now Section 7.1: "Abundance and Distribution of Fishes in the Mine Scenario Watersheds." This section still appears to contain the same discussion on the interpretation of available fish distribution data, which is overlaid on the revised version of the mine scenarios. The risk analysis does not meet EPA standards. The comment stands.

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Page	**Section**	**Excerpt**	**Contributor**	**Response/Comment**	**Recommended Change**	**Addressed?**	**Comments**
5.59	Report Section Identification : 5.4.1 through 5.4.6		State of Alaska	Comment: These subsections are not risk assessment. There are no set conditions defined that, if met, would constitute risk or no risk. There is no comparison of likely conditions to acceptable conditions. Thus, there is no assessment of risks. Rather, there is just a litany of potential effects listed. Essentially, the risk characterization for these subsections reiterates that any and all of the bad things related to roads "could" happen. It does not provide that any specific risks would, or are likely to, occur. Without this, the section is just saying, "there is a risk of these things happening", without any likelihood estimation. Without some form of likelihood or some thresholds, any decision making or conclusions become based on individual interpretation and not a shared basis of understanding.	Recommended Change: Conditions or design thresholds, or a range of such, must be described that, if not met, could/would result in ecologically unacceptable conditions.	No	The risk characterization portion of the road construction does not address specific risks. The comment stands. The assessment needs to incorporate mitigation and design features that would offset impacts. The assessment also needs to be revised to truly assess the risk of events. This analysis does not meet EPA's standards for risk assessment.

EPA-7609-0003748_0041

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Page	**Section**	**Excerpt**	**Contributor**	**Response/Comment**	**Recommended Change**	**Addressed?**	**Comments**
5.64	Section 5.4.7		Environ	This section seems to assume that the requirements under Section 404(b) of the Clean Water Act will not apply to the project. This is not a good assumption. If impacts to wetlands are unavoidable, mitigation will be required.		No	Only the filling of wetlands is addressed in the risk characterization section, not the potential for wetland mitigation. Compensatory mitigation is addressed in Box 7-2. The statement in the Executive Summary indicates that, "Compensatory mitigation measures could offset some of the stream and wetland losses, although there are substantial challenges regarding the efficacy of these measures to offset adverse impacts." (page ES-26). The analysis does not include any assumptions regarding design features that would avoid impacts and/or mitigation measures that would offset impacts, therefore, the document overstates the impacts that would be expected.
6.21	Report Section Identification : 6.1.4.1		State of Alaska	Draft Comment: Note that in the absence of a bioaccumulation factor (BAF) in the peer reviewed literature, a default value of 1 is used. The referenced studies therefore reinforce the use of this default BAF. However, an inverse relationship between BAF and media concentrations has been demonstrated in the majority of test species as reported by David K. DeForest et al.	Draft Recommended Change: Include more recent studies of BAFs. Comment Reference: Assessing metal bioaccumulation in aquatic environments: The inverse relationship between bioaccumulation factors, trophic transfer factors and exposure concentration, David K. DeForest,, Kevin V. Brix , and William J. Adams Aquatic Toxicology 84(2007) 236-246	No	The report still uses an average BAF of 1.0, rather than the inverse relationship established by DeForest et al. 2007.

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Page	**Section**	**Excerpt**	**Contributor**	**Response/Comment**	**Recommended Change**	**Addressed?**	**Comments**
6.24	Report Section Identification : 6.1.4.3		State of Alaska	Draft Comment: This is the first instance in the report in which an attempt is made to define the hazard quotient. The text defines the hazard quotient as "the relative degree of toxicity of leachate constituent or as an indication of the degree of dilution required to avoid significant toxic effects". This interpretation is somewhat simplistic and does not provide insight into what the value means.	Draft Recommended Change: Provide EPA's definition EPA defines the HQ as the ratio of estimated site-specific exposure to a single chemical from a site over a specified period to the estimated daily exposure level, at which no adverse effects are likely to occur. Provide an interpretation of the HQ as HQs < 1.0 indicate acceptable risks, while HQs > 1.0 indicate unacceptable risks while also taking into consideration the inherent uncertainty in the estimate. Comment reference: Draft Comment Reference: U.S. Environmental Protection Agency (December 1997) Terms of Environment: Glossary, Abbreviations and Acronyms. [online] Washington, D.C. Available from: http://www.epa.gov/OCEPAterms/ [accessed 27 October 2007].	No	While some additional guidance on interpreting risk quotients has been provided in the text (Text Box 8-3), this information is incorrect and not based on guidance available from USEPA for the conduct and interpretation of Screening Level Risk Assessments: United States Environmental Protection Agency (EPA). 2001. The role of screening level risk assessments and refining contaminants of concern in baseline ecological risk assessments. Office of Solid Waste and Emergency Response, Publication 9345.0-14, EPA 540/F-01/014. June 2001. United States Environmental Protection Agency (EPA). 2012. Technical Overview of Ecological Risk Assessment. Risk Characterization http://www.epa.gov/oppefed1/ecorisk_ders_toera_risk.htm. Last updated May 09, 2012. Accessed May 6, 2013. Hence, the characterization of risk is incorrect.

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Page	**Section**	**Excerpt**	**Contributor**	**Response/Comment**	**Recommended Change**	**Addressed?**	**Comments**
6.42	section 6.4		ENVIRON	As was discussed in prior comments, this section assumes that roads and culverts would be built to standards that have long been abandoned. The analysis needs to be completed under the assumption that roads and culverts will meet or exceed current engineering standards and current regulations.		No	The assumptions are not based on current standards for roads and culverts, and assume failure of standards depending on installation problems or subartic conditions. Since current construction standards and federal and state requirements are not included in the assumptions for the project design, the analysis overstates the likely impacts.
7.9	Section 7.4 - 7.4.7, page 7-9 - 7-16		ENVIRON	Section 7.1 - 7.3 discusses the probability that additional mining deposits would be developed in such a way as to make use of the existing Pebble deposit infrastructure (TSF, pipelines, roads, etc.) thus creating an economy of scale of development in the area. The potential for other mine developments to combine resources and share infrastructure is a very real possibility, given the cost of development in rural Alaska. Creating a shared infrastructure network could also have a positive impact on the environment by reducing the foot print of projects in the watershed. Although sharing infrastructure is hinted at in the first sections, in Section 7.4 - 7.4.7, the report ignores their earlier assertion and assumes that each mine development would build their own transportation corridors and TSF, thus increasing the cumulative effects substantially.	Comment reference: Hughes, A. (2010) Disturbanc e and Diversity: An Ecological Chicken and Egg Problem. Nature Education Knowledge 1(8):26 A. Randall Hughes * and John J. Stachowicz PNAS June 15, 2004 vol. 101 no. 24 8998-9002 Ruth Young.Feb 9th, 2010. Biodiversity: what it is and why it's important. Talking Nature.com Garry Peterson, Craig R. Allen and C. S. Holling. Ecological Resilience, Biodiversity, and Scale. Ecosystems Volume 1, Number 1 (1998), 6-18, DOI: 10.1007/s100219900002	No	Infrastructure sharing is mentioned only a few times in Chapter 13 Cumulative Effects, in one case it is part of a shared/unshared scenario, and in another only partial sharing is assumed. The analysis does not make an adequate attempt to consider all possible scenarios in this assessment.

EPA-7609-0003748_0044

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Page	**Section**	**Excerpt**	**Contributor**	**Response/Comment**	**Recommended Change**	**Addressed?**	**Comments**
	Report Section Identification: Appendix I, Volume 3		State of Alaska	Comment: Appendix I in Volume 3, Conventional Water Quality Mitigation Practices for Mine Design, Construction, Operation, and Closure by Barbara A. Butler, Ph.D. is a primer on mine waste written at a very basic level. It is heavily weighted towards the review of waste rock and tailings storage at hard rock mines (Section 1 and 2), and quickly loses detail and consistency as it discusses other mine features and waste streams such as pits, underground mines, dust, stormwater, chemicals, pipelines, and sanitary wastes. (Sections 3 through 9). In general, the report describes the feature or waste stream, the potential mechanisms or pathways for impacts to the environment, and mitigation measures presented as standard engineering and regulatory practices related to those aspects. For example, waste rock that may be potentially acid generating would be mitigated through a characterization plan, and encapsulated in storage. The body of the report is heavily referenced to a variety of publications including controversial references such as ICOLD, 2001 (Tailings Dams, Risk of Dangerous Occurrences) to potentially stale references such as Piteau Associates Engineering, 1991 (Mined Rock and Overburden Piles—investigation and design manual: Interim guidelines) to recent non-scientific publications such as Chambers and Higman, 2011 (Long term risks of tailings dam failures), as well as some government publications such as the States of Alaska (ADNR, 2005) and Idaho, USEPA, and Commonwealth of Australia. The final section on compensatory mitigation is abbreviated, and introduces the only references to legal issues, related to U.S. Corps of Engineers regulatory jurisdiction for wetlands. The cover page is dated May 2012		No	With the exception of Section 10. Compensatory mitigation (which has been deleted in Appendix I of the second review draft), Appendix I has been included in the second draft with no apparent revisions. Failure to address compensatory mitigation and to incorporate mitigation that would likely be required of a project has resulted in over-statement of likely project effects throughout the document.

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Page	**Section**	**Excerpt**	**Contributor**	**Response/Comment**	**Recommended Change**	**Addressed?**	**Comments**
15, 16, 81 and 82	Report Section Identification : Volume 3 Appendix E		State of Alaska	Comment: These pages discuss the value of the fishing, subsistence fishing, hunting and recreation industries for Bristol Bay and list the part and full time jobs that are provided by these industries. By the nature of the weather, most of these jobs are part time. Also, no discussion of the high paying full time jobs is provided for the mine operation. A reader of the Bristol Bay Watershed Assessment Executive Summary and Appendix E versus one reading the Northern Dynasty Minerals, Ltd. report of 2011 will arrive at two different conclusions. The Northern Dynasty Minerals, Ltd. report states that the area has significantly dropped in population (16% since 1997) due to lack of jobs and that the price of sockeye salmon has dropped from an inflation adjusted peak of $3.75 in 1988 to $0.60 after the year 2000. Data presented in the Assessment on pages 81 and 82 of Volume 3 Appendix E show that prices are on the rise again although the graphs show fluctuations over time. However, none of this valuable information seems to have been included in the Executive Summary. The Executive Summary fails to state that the price has not recovered to what it was in the 1980s. The Northern Dynasty Minerals, Ltd. report fails to state that the price has made somewhat of a comeback since 2006.	Recommended Change: Include some of the fisheries statistical data that is in Appendix E in the Executive Summary. Also, it should be stated in the Assessment that the mine would provide 2500 jobs during a 4 year construction period and 1100 full time jobs over the life of the mine. All of these jobs are full time and high paying. Comment reference: Northern Dynasty Minerals "Preliminary Assessment of the Pebble Project Southwest Alaska" issued on February 17, 2011, by Wardrop, a Tetra Tech Company, page 419	No	Page ES-9 does not include any fishing price data or mining job information. The document states "The economic effects of mining are not assessed." As a result, the economic analyses are incomplete and fail to represent actual economic impacts.

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Page	**Section**	**Excerpt**	**Contributor**	**Response/Comment**	**Recommended Change**	**Addressed?**	**Comments**
A1.8	Appendix I, p 8		Environ	This section continues on to detail impacts from runoff, erosion, sedimentation, etc. No mention of Best Management Practices (BMPs) is made. There are great advances in BMPs for designing retention and detention canals and basins, to timing and location of icing, snow removal, and design of the roadway to accommodate these BMPs.		No	The heading 'Standard Practices' replaced with 'Conventional Practices'; but no substantial changes have been made in the text to indicate that the use of BMPs has been incorporated into the analysis. The project assumes a standard of construction that is highly unlikely to be permitted. Failure to assume levels of mitigation that would be reasonably required by state and Federal regulations has resulted in an assessment which grossly overstates potential project effects.
AI.9	Appendix I, p 9, paragraph 2		Environ	This section details thee distinct types and scales of impacts from roadways - nothing is said about attempts to pre-plan to avoid or minimize these effects, or mitigation for any of the impacts. And again some of this analysis belongs in a good strong cumulative impacts analysis.		No	This comment has not been addressed. The analysis therefore addresses a project situation which cannot be permitted. This situation continues throughout the document. Failure to assume levels of mitigation that would be reasonably required by state and Federal regulations has resulted in an assessment which grossly overstates potential project effects.
AI.9	Appendix I, p 9,10		Environ	This entire section does not take into account BMPs and avoidance techniques.		No	This comment has not been addressed. The analysis therefore addresses a project situation which cannot be permitted. This situation continues throughout the document. Failure to assume levels of mitigation that would be reasonably required by state and Federal regulations has resulted in an assessment which grossly overstates potential project effects.

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Page	**Section**	**Excerpt**	**Contributor**	**Response/Comment**	**Recommended Change**	**Addressed?**	**Comments**
All	Report Section Identification : Executive Summary and Throughout		State of Alaska	Comment: Overall, it is uncertain and unquantified what the actual impacts of the mine are likely to be. No reasonable maximum or average impact to fish and wildlife are provided. While it can be stated with certainty that the mine pit, waste rock piles, and tailing storage facilities (TSF)+ will cover fish and wildlife habitat, the percentage of that impact on localized and regional fish and wildlife populations and the economic impact it may have, are never quantified. TSF dam construction and failure is the single most significant issue related to fish and wildlife impacts. Much more detailed information is needed on groundwater flow and its relation to overall water balance		No	Water balance has been addressed in more detail (Section 6.2.2), but not in a way that allows more accurate analysis of impacts to fish and wildlife. Some of PLP's 2011 data have also been incorporated, but the analysis does not account for the full range of scale in its impacts assessment, and is limited to patchy information on local populations. The comment stands. Failure to address this comment likely has resulted in an over-estimation of potential project effects.
ES.5	Report Section Identification : Executive Summary – Scope of Assessment and Elsewhere in the Document		State of Alaska	Comment: The document states that other deposits in the region would present risks similar to those outlined in the assessment. It is presumptuous for the EPA to assume other deposits in the area would have similar risks as Pebble. Later in the document, a comparison of the chosen scenario for Pebble, would make it the largest mine in North America. As hypothetical and unlikely as that assumption is, it is even more unlikely that other deposits in the region would be of the same scale and present similar risks. The document does state elsewhere that the other deposits are not likely to be as large as Pebble but it is contradictory to state that they would have "similar impacts" in the executive summary.	Recommended Change: The executive summary should not state that other deposits will have similar impacts.	No	Similar language remains in the 2013 ES. The assumption that all mines would be similar is unfounded. The statement and the assumption results in over-estimation of cumulative effects of other mine developments in the area.

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Page	**Section**	**Excerpt**	**Contributor**	**Response/Comment**	**Recommended Change**	**Addressed?**	**Comments**
ES.9	Report Section Identification: Volume 1 Economics of Ecological Resources		State of Alaska	Comment: There's no effort made to quantify how many of the workers and how much of earnings are made by non-residents. According to Alaska Department of Labor and Workforce Development Research and Analysis Bristol Bay Region Fishing and Seafood Industry Data in 2009, 58.8% of total gross earnings earned by non-resident permit holders and 87.1% of wages were earned by non residents. The characterization of the Bristol Bay Commercial Fishery is incomplete without a reflection of the profits gained from Alaska's fisheries resources by non residents and how much of the gross earnings leave the state, is not spent in Alaska, or in the Bristol Bay region. Similar data presented for the general public is also published the November 2009 issue of Alaska Economic Trends published by the Alaska Department of Labor and Workforce Development, including that in 2008: • 46% of Alaska's crew members lived outside the state • 73% of seafood processing employees lived outside the state and they earned $187 million that year • Seafood processing since at least the mid-1980s8 has been the sector with the highest percentage of nonresidents, both within the fishing industry and in all wage and salary employment in the state. Warren, J. and Hadland, J. Employment in Alaska's Seafood Industry in Alaska Economic Trends November 2009. State of Alaska Department of Labor and Workforce Development, Research and Analysis Section.. pp. 4-10. p. 6-7 and Exhibit 7. Alaska Department of Labor and Workforce Development Research and Analysis. Fishing and Seafood Industry in Alaska Current Data. Fishing and Seafood industry in Alaska Overall Seafood Industry Data Tables. Fish Harvesting and Processing Workers and Wages. Bristol Bay Region Seafood Industry, 2003-2009.		No	This section (page ES-9) makes no mention of out-of-state workers. Failure to include out-of-state workers is a significant shortcoming in the analysis. The analysis is therefore incomplete and misrepresents actual expected effects.

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Page	**Section**	**Excerpt**	**Contributor**	**Response/Comment**	**Recommended Change**	**Addressed?**	**Comments**
General	Report Section Identification: General comment on risk estimates.		State of Alaska	Given the uncertainty in the mine plan, numerous data gaps in the assessment of current conditions, use of conservative risk screening criteria, uncertainty in measured concentrations or parameters, and consideration of potential risk mitigation measures, risk might be better discussed in a more qualitative manner or using probabilistic risk assessment techniques. Using probabilistic risk assessment the uncertainty and variability in the risk assessment estimates might be used to better predict the magnitude of expected impacts.		No	While the probability of various events is discussed in both versions, there does not appear to be any substantial differences between the two versions. The comment was not addressed. The analysis would be significantly improved if the comment were addressed.
Re ort Number :2.1 through 2.26	Report Section Identification :Chapter 2		State of Alaska	Draft Comment: This chapter is lacking sufficient detail expectant of a discussion of current conditions, more appropriately referred to as background or baseline conditions. The area's biodiversity instead is generalized in tables and figures. There is no discussion of current water quality for each of the 17 hydrogeologic areas nor any habitat mapping, biological survey information, and threatened or endangered information. A more in-depth evaluation of wildlife is provided by U.S. Fish and Wildlife in Appendix C and should be referenced more prominently in this chapter.	Draft Recommended Change: Include additional information describing current (baseline) conditions and reference Appendix C more prominently.	No	No additional baseline info specific to species was added and the requested citations were not added to Appendix C. Comment stands. Analysis is inaccurate and/or incomplete.
Re ort Number :2.15 through 2.17	Report Section Identification :Sections 2.2.2 and 2.2.3		State of Alaska	Draft Comment: Consideration of threatened or endangered species is an important aspect of the ecological risk assessment, but yet they are not are not discussed in these sections.	Draft Recommended Change: List known of suspected threatened species within the study area.	No	No additional baseline info specific to species was added, and additional citations of Appendix C have not been provided. Failure to adequately address listed species represents a major shortcoming in the analysis.

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Page	**Section**	**Excerpt**	**Contributor**	**Response/Comment**	**Recommended Change**	**Addressed?**	**Comments**
Re ort Number :ES.23	Report Section Identification : Executive Summary Fish-Mediated Risk to Wildlife		State of Alaska	Draft Comment: Aside from fish mediated risks to wildlife, it might also be pertinent to discuss other issues impacting wildlife including elimination or change in habitat due to avoidance or attractive nuisances of the mine.	Draft Recommended Change: Discuss elimination or change in wildlife habitat due to avoidance or attractive nuisances of the mine.	No	No direct effects to wildlife from mine footprints were analyzed in the report; rather, direct effects of mining were considered beyond the scope of the assessment (page 12-5). This renders the analysis of wildlife impacts incomplete.
2.17	Section 2.2.4	Table 2.6	ENVIRON	The only justification for the values of each economic sector states "see Appendix E for additional information on these values." There are many calculations and value estimates throughout Appendix E. In order to be able to verify calculations specific references to specific locations in Appendix E need to stated.		No	Section 5.2.3, Pages 5-23 and 5-24. This section is almost identical to previous Section 2.2.4. adding no additional information as recommended. Page 1.2 states "This assessment is not an environmental impact assessment, an economic or social cost-benefit analysis, or an assessment of any one specific mine proposal." And page ES-9 states "The economic effects of mining are not assessed." Comment was acknowledged but not addressed. Therefore the original comment still stands.
5.74	Section 5.5		ENVIRON	This section assumes that impacts described in previous section on fish will occur. The prior comments on those sections need to be addressed and this section needs to be re-written in light of the analysis errors in the prior sections.		No	The same assumptions were made for the revised version and the analysis continues to overstate impacts due to the assumptions that the project will not be designed to minimize impacts and the project will not include appropriate mitigation as required by State and Federal regulations.

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Page	**Section**	**Excerpt**	**Contributor**	**Response/Comment**	**Recommended Change**	**Addressed?**	**Comments**
5.76	Section 5.5	1st full paragraph	ENVIRON	The assumption that subsistence users will be displaced is unfounded. Once a road is available, the most likely outcome is that subsistence use will increase.		No	Acknowledgement of greater accessibilty in made in Page 12-8 paragraph **4**, but with enough caveats to make it of litte significance. The comment stands. Unless the comment is addressed, the analysis does not accurately reflect changes in subsistence use expected with changes in access.
AE. 102.104	Appendix E		ENVIRON	The estimate of costs of fishing is difficult to characterize, as admitted by the authors. The one summary of costs was provided for the year 2008 to show the kinds of costs important to the fishing industry as well as the potential magnitudes of each kind of cost relative to the same years' earnings. It is important to remember that there is a great amount of uncertainty in fishing costs, which needs to be taken into consideration when attempting to determine impact assessments.		No	Pages 101-103 indicate there were no changes to the analysis and therefore no attempt to improve the accuracy of the assessment. The comment stands.
AE. 191	Appendix E		ENVIRON	Another limitation of the ISER Input-Output model is that it is only focused on market values so it is unable to determine the economic significance of subsistence in terms of direct jobs and incomes. These types of limitations should persuade the authors to find a way to incorporate these factors into the analysis.		No	Text on page 191 is identical to previous draft, therefore no attempt to improve the accuracy of the assessment. The factors have not been incorporated into the analysis, therefore the analysis is incomplete.

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Page	**Section**	**Excerpt**	**Contributor**	**Response/Comment**	**Recommended Change**	**Addressed?**	**Comments**
2.24	Section 2.3.4	1st paragraph	ENVIRON	The logic presented in these two paragraphs is flawed since it assumes that all the returning fish escape into the rivers to spawn. Per Figure 6-1, the average escapement into the entire study area averages 16,142 fish, not 30 to 40 million . At an average size of 2.32 kg per fish (Burgner 1991), this is equivalent to approximately 37,500 kg of fish. Only a small percent of that weight is nitrogen and phosphorus (typically 11 to 12 percent nitrogen). So the total import must be less than 4,000 kg of nitrogen and smaller amount of phosphorus, not the estimated 20 million kg reported in the referenced paragraphs. Also worthy of note, Moore and Schindler (2004) indicate that on average, smolts export 12% of the phosphorus and 16% of the nitrogen that their parents bring in, so the nutrients available to other biota are smaller than the total nutrients imported by the parents.		No	Essentially, the same analysis is presented in Section 5.2.5 of the second review draft as was presented in Section 2.3.4 of the first review draft. The comment was not addressed. The assumption that all returning fish escape into the river grossly over-estimates the impacts of a project on nutrient availability.
2.9	Report Section Identification : 2.2		State of Alaska	Comment: Only resident, non-anadromous Dolly Varden are considered in the assessment but there are significant anadromous Dolly Varden populations in the Kvichak and Nushagak watersheds.	Recommended Change: Consider incorporating anadromous Dolly Varden of the Kvichak and Nushagak watersheds in the assessment.	No	Chapter 7 - Anadromous Dolly Varden are not addressed, and no reason given as to why this is so. Dolly Varden should be included in the analysis.
4.34	Section 4.3.9.1	paragraph 2	ENVIRON	The final design of the "generic" project that is the subject of this report has not been developed and could include any number of road configurations and destinations. The paragraph needs to acknowledge that alternative routes and destinations could be identified.		No	This has not been addressed, and the same language remains in Section 6.1.3. The analysis presumes a single route and does not provide options for additional consideration. Failure to include design features that would mitigate impacts results in an overstatement of project effects.

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Page	**Section**	**Excerpt**	**Contributor**	**Response/Comment**	**Recommended Change**	**Addressed?**	**Comments**
4.36	Section 4.3.9.1	paragraph 1	ENVIRON	The cited reference makes assumptions regarding the number of culverts and bridges, but these assumptions may not be relevant once a project is designed and permitted.		No	The issue has not been addressed in the revised text (although the number of bridges increased by one). As with other comments on the roads analysis, this is another example of using assumptions that do not meet current construction standards.
4.36	Section 4.3.9.1	last sentence	ENVIRON	The fact that culverts washed out may not be pertinent to the assessment. Were the culverts that washed out constructed in accordance with today's standards and BMPs? If not, this sentence should be deleted.		No	This issue has not been addressed. The unstate assumption remains that culverts have a high potential to washout despite advances in technology or implementation of mitigation measures.
5.1	Report Section Identification : 5.1.2 Spawning Salmon Abundance		State of Alaska	Comment: The repetition of the fact that fish numbers were underestimated, similar to the report-wide repetition of the importance of groundwater-to-surface water interactions, seems to be an attempt to influence the reader, without adequate supporting data. In the last sentence of the first paragraph of this section it says true spawner abundance is underestimated by a "...large and unknown factor." It is unclear that this is true for the Pebble Mine area where a large number of headwater streams are present.	Recommended Change: Use site-specific data instead of broad generalizations. Provide the data, summarize, and move on. Remove repetition. Address in uncertainty section if needed.	No	The term "underestimate" was emphasized throughout the 2013 version. Within Section 7.1.2 (which was Section 5.1.2), additional information was provided regarding why it was considered an underestimate of the spawning salmon abundance, with the sentence: "We recognize that survey values tend to underestimate true abundance for two reasons: an observer in an aircraft is not able to count all fish in dense aggregations, and only a fraction of the fish that spawn at a given site are present at any one time (Bue et al. 1988, Jones et al. 2007)." This does not adequately address the comment.

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Page	**Section**	**Excerpt**	**Contributor**	**Response/Comment**	**Recommended Change**	**Addressed?**	**Comments**
5.1	Report Section Identification: 5.1.2		State of Alaska	Comment: It is stated that the abundance counts "...underestimate true abundance by a large and unknown factor" and "...true spawner abundance is probably substantially higher than the values presented..." However, by using the "highest" index counts, it is likely to be representative, or possibly an overestimate of average, and applying this "highest" index count across an entire stream system, or even across large areas (i.e., reaches) of the stream where spawning may or may not occur (because spawning is generally restricted to particular reaches or habitat conditions that do not exist everywhere in the stream), could very well overestimate impacted numbers of fish. In addition, the values presented in Table 5-1 seem to be consistent with the reported numbers of sockeye and Chinook by the ADFG counts since 1955. With over 30 years of data, apparently consistent with the 4 years of data collected for the Pebble Limited Partnership Environmental Baseline Data, using the highest index count may result in an overestimate of the number of impacted salmon. Further, the Northern Dynasty Tailings Impoundment A Initial Application Report by Knight Piesold (September 2006) clearly states that TSF areas were selected because of a measured lack of significant populations of anadromous fish. Some level of verification between the EPA estimated direct fish impact and the Northern Dynasty fish data would seem to be needed.	Recommended Change: Provide discussion on similarity/differences between Pebble Limited Partnership Environmental Baseline Data (2004-2008) data and ADFG (1955 on) data, and be clear and correct on likelihood of over or under estimation of numbers, particularly across stream reaches/areas. It would be prudent to more clearly separate out discussion of effects into those caused by habitat lost under/upstream of the mine and TSF areas (e.g., direct), and those downstream from the mine area (e.g., indirect). Edit language to refrain from broad statements of significance of impact without site-specific data analysis to show it.	No	no comparison of the ADFG counts and PLP counts was provided. The discussion of the two data sets appeared to be mostly unchanged. There is no clear indication of when the estimates were an over or under estimation. The structure of the effects discussion is largely the same, separating out habitat modifications, stream flow modifications, and water quality issues from the effluent. The comment still needs to be addressed.

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Page	**Section**	**Excerpt**	**Contributor**	**Response/Comment**	**Recommended Change**	**Addressed?**	**Comments**
5.12	Report Section Identification : 5.2 Fish Distribution		State of Alaska	Comment: Blanket statements are provided for fish with priority habitats (spawning, rearing, etc.) under the proposed footprint of the storage facilities, but for chum the habitat area under the storage facility is not shown, and for other salmon the relatively small area of the impacted priority habitat is not mentioned...rather a blanket statement is made that the habitat will be impacted. Making this statement without qualification or reference to further analysis, leads the reader to an initial conclusion of "impact" without understanding extent of that impact. TSF 2 and TSF 3 are often referenced, but are not included on Figures 5-1 through 5-7. Frying Pan Lake and Koktuli Mountain are referenced for, but not included on, Figure 5-6.	Recommended Change: A qualifier or some reference to further analysis in Section 5.2 should be added to provide readers with an understanding of the general size of the impact. It doesn't have to be really specific, or the reader should be referenced to Section 5.2 for further insight to the level of impact. Add TSF 2 and 3 to Figures 5-1 through 5-7. Add Frying Pan Lake and Koktuli Mountain to Figure 5-6.	No	Impacts to fish are typically lumped without consideration of species. The only species-specific discussion is on page 7-27, which is the same information presented on page 5-16 of the original document. TSF2 and TSF3 labels were provided on Figure 7-12, but not included on the fish distribution maps (Figures 7-2 thru 7-8 or old Figures 5-1 thru 5-7). Frying Pan Lake and Koktuli Mountain were not added to the dolly varden figure.
5.16	Section 5.2.1.2 and Appendix C		ENVIRON	The assessment states that the loss of upstream waters (pg. 5-21, pg. 1) would " greatly reduce inputs of organic material, nutrients, water, and macro invertebrates to reaches downstream ....". The report also state that 65% of the nitrogen flux is attributed to headwater contributions. Appendix C (p 16-18) documents the tremendous importance of Marine-derived Nutrients to the Bristol Bay Watersheds coming in from salmon swimming upstream.		No	The discussion on nutrient contribution of headwater streams is largely unchanged. The marine-derived-nutrients provided by salmon swimming upstream was only considered in terms of potential impacts to wildlife, but not an overall addition/loss of nutrients in the system. Hence, the analysis remains incomplete; all sources of nutrients need to be included in the assessment.

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Page	**Section**	**Excerpt**	**Contributor**	**Response/Comment**	**Recommended Change**	**Addressed?**	**Comments**
5.16	Section 5.2.1.2		ENVIRON	Organic inputs and nutrients from areas upstream of the proposed mine site are unlikely to provide a vast quantity of materials to downstream third and fourth order streams. Drifting macroinvertebrates directly downstream might diminish to a degree, but the amount of the reduction would be a direct result of the footprint size and location, and what types of vegetation etc., would be removed, and through avoidance, minimization and mitigation techniques, this could be contained to a minimal impact.		No	The discussion on the importance of headwater streams, and the nutrient contribution, is largely unchanged between 2012 and 2013. The discussion is fairly general, and it does not appear the get incorporated into the potential impacts discussion, just in terms of overall loss of nutrient sources. However, it is also not recognized that these impacts could be minimized or avoided depending on the vegetation removed. This is another example of a case where the assumed lack of mitigation results in an overstatement of effects.
5.16	Report Section Identification :5.2.1.1		State of Alaska	Draft Comment: Text states that loss of headwater habitats will have indirect impacts on fishes and their habitats in downstream mainstream reaches of each watershed. However, it is not prefaced that this assumption does not take into consideration any risk mitigation measures such as stream diversions.	Draft Recommended Change: Preface that this assumption is based on no mitigations measures implemented to reduce potential impacts.	No	This statement in the text remains unchanged. The document consistently assumes minimal to no mitigation or avoidance of environmental effects. Failure to define a project that meets current standards regarding construction, design, mitigation, and avoidance of impacts results in an overstatement of effects throughout the document.

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ORIGINAL DRAFT LOCATION			ORIGINAL COMMENT			COMMENTS REGARDING ADEQUACY OF RESPONSE IN SECOND DRAFT	
Page	**Section**	**Excerpt**	**Contributor**	**Response/Comment**	**Recommended Change**	**Addressed?**	**Comments**
5.21	Section 5.2.2.1	first paragraph	ENVIRON	The report assumes that impacts to stream flow will not be mitigated. This is probably not a good assumption. In assuming no mitigation, you have assumed a worst case scenario. The report should explain that this is a worst case scenario and should also discuss possible approaches to mitigating the impacts.		No	There was no discussion on potential mitigation within the streamflow assessment, other the statement, "Alternative flow management strategies may be feasible, depending on the capacity to store and release flows to meet environmental flow objectives." (page 7-59). This does not adequately address the comment. The assumptions of the analysis should have included a project design in line with current construction standards and the mitigation that would be required to meet state and Federal regulations. Failure to assume a project design that meets current design and regulatory requirements results in an analysis that consistently overstate s likely project impacts.

EPA-7609-0003748_0058

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Page	**Section**	**Excerpt**	**Contributor**	**Response/Comment**	**Recommended Change**	**Addressed?**	**Comments**
5.3	section 5.2.2.3		ENVIRON	Due to the failure to consider approaches to mitigate reductions in flow (e.g. drill a well into a hydrologically disconnected aquifer and augment flow), this section overstates likely impacts of a project.		No	No mitigation was proposed for streamflow modifications, other the statement, "Alternative flow management strategies may be feasible, depending on the capacity to store and release flows to meet environmental flow objectives." (page 7-59). This does not adequately address the comment. The assumptions of the analysis should have included a project design in line with current construction standards and the mitigation that would be required to meet state and Federal regulations. Failure to assume a project design that meets current design and regulatory requirements results in an analysis that consistently overstates likely project impacts.

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Page	**Section**	**Excerpt**	**Contributor**	**Response/Comment**	**Recommended Change**	**Addressed?**	**Comments**
5.3	Report Section Identification : 5		State of Alaska	Comment: When reading the text in the Executive Summary, Chapter 2, Chapter 5, Appendices A through F, much discussion is based on the entire Bristol Bay region. However, unless there is a water quality issue downstream or a dam break, the effects to the entire Bristol Bay region would be minimal. The Figure on page 5-3 shows that there is no rearing or spawning area of pink salmon anywhere near the mine disturbance. The Figure on page 5-4 shows that there is no rearing or spawning area of chum salmon near the mine disturbance. The Figure on page 5-5 shows that there is no rearing or spawning area of sockeye salmon in the mine disturbance (although it is close). The Figure on page 5-6 shows that there is minor rearing or spawning area of Chinook Salmon in the mine disturbance, and the Figure on page 5-7 shows that there is definite rearing or spawning area of coho salmon in the mine disturbance, but it is small in extent and at the head of the watersheds compared to the rest of the entire Bristol Bay region. The Figure on page 5-8 shows significant use by Dolly Varden fish, but this fish does not appear to be of great value in the Bristol Bay region. It appears that the Bristol Bay Watershed Assessment is constantly citing the overall value of Bristol Bay region fisheries but downplays the actual amount of these stream lengths (that have the valuable fish) which would be affected by the mine.	Recommended Change: Depict more accurately the amount of stream segments that are rearing and spawning areas for the valuable fish and which could be affected by the mine and compare them to the total length of rearing and spawning lengths for the Bristol Bay region. It will be seen that the amount of blocked and eliminated segments are a very small percentage of the total for the region.	No	There is no detailed analysis of the amount of stream segments that are potentially affected compared with the species and life stages used in these areas, aside from what is presented in Figures 7-2 thru 7-8. Tables 13-2 thru 13-7 do have the potential overlap of affected waters with species and life stages present, but there is no indication of the extent to which the overlap occurs (i.e., km of stream or area of lake/wetland impacted). The comment has not been adequately addressed. Failure to incorporate the relative value of the headwater habitats to the entire populations of each species results in an overstatement of effects.

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Page	**Section**	**Excerpt**	**Contributor**	**Response/Comment**	**Recommended Change**	**Addressed?**	**Comments**
5.42	Section 5.2.2.3	1st paragraph	ENVIRON	Due to the failure to consider approaches to mitigate reductions in flow (e.g. drill a well into a hydrologically disconnected aquifer and augment flow), this section overstates likely impacts of a project.		No	mitigation measures were not considered for streamflow reductions, other the statement, "Alternative flow management strategies may be feasible, depending on the capacity to store and release flows to meet environmental flow objectives." (page 7-59).
5.45	Section 5.2.3		ENVIRON	The risk analysis should have included an evaluation of the likelihood that the assumed project would be constructed. This would include an analysis of the likelihood that construction would be permitted without mitigation of significant potential effects.		No	There is no indication of the likelihood of construction within the document. The document continues to assume the mine would be constructed to standards that cannot be permitted in today's regulatory environment. As a result, the assessment does not provide a reasonable evaluation of the potential impacts of a project. all impacts are overstated due to the assumptions regarding a lack of mitigation and insufficient planning to avoid impacts.

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Page	**Section**	**Excerpt**	**Contributor**	**Response/Comment**	**Recommended Change**	**Addressed?**	**Comments**
5.49	Report Section Identification : Vol 1 Section 5.3.1		State of Alaska	Comment: The biotic ligand model is used to derive criteria on page 5-49 despite not being introduced until page 5-53. The values for copper derived from the biotic ligand model in Table 5-14 and 5-15 do not match the values in Table 5-19. East and West Pre-Tertiary values are swapped. Table 5-19 shows the acute criterion for the biotic ligand model for Pebble West Pre-Tertiary to be 0.43 µg/L. Table 5-15 on Page 5-50 shows it as 0.043 µg/L. All the biotic ligand values derived for copper need to be verified and accurately labeled in Tables 5-14 through 5-16 and Table 5-19. These values are used to derive dilution calculations highlighted on page ES-21. Furthermore, the chronic criteria are 10 and 90 times more stringent for the biotic ligand model than the state's water quality standards for the West and East Pre-Tertiary waste rock respectively. This is a significant difference. The lead in sentence to Table 5-19 should provide table references for the mean chemistries of the waste rock leachates. See comment for pages 5-53 to 5-37.	Recommended Change: Move Tables 5-14 through 5-16 to after Table 5-19 or remove the biotic ligand model derived criteria from Tables 5-14 though 5-16. Provide a footnote for the column header "Average Value" indicating number of leachate tests performed. Review inputs and outputs from the biotic ligand model and correct errors in values and references to East and West Pre-Tertiary waste rock in Tables 5-14, 5-15, 5-16, and 5-19.	No	The tables have been moved to section 8. The numbers remain the same. It is not possible to determine if the model results were checked as requested.

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Page	**Section**	**Excerpt**	**Contributor**	**Response/Comment**	**Recommended Change**	**Addressed?**	**Comments**
5.57	Report Section Identification: 5.3.2.2		State of Alaska	Comment: The section on "analogous" sites is too general to be of use in risk determination. It raises the issue of the adequacy of current water quality criteria, but there is not enough information provided on conditional differences between analogous sites and the Pebble Mine site to make any inferences. Water quality, leachate parameters, acidity, water flow, stream substrate, stream invertebrate assemblages, among other conditions all may be different. The research cited in this section also suggests that there may be impacts to stream macroinvertebrates at concentrations below the water quality criteria, but essentially there is no quantification of the potential impact or the level below the criteria that is unacceptable. One article suggests a factor of 10 below the criteria provided acceptable protection. This argument would seem to be more appropriate in setting new criteria, and until such criteria are provided, there doesn't seem to be any basis for requiring concentrations below EPA approved Alaska Water Quality Criteria, apart from an APDES permitting process that takes into account site-specific conditions. No discussion is provided on any "acceptable" level of impacts to stream invertebrate populations while maintaining healthy fish populations. Siltation of the streams with contaminated sediment should be a principal concern in any mine development/permitting and effects determination.	Recommended Change: Further examination of site-specific mine conditions and potential impacts should include stream invertebrate sampling, enumeration, and analysis to establish baseline conditions.	No	Largely addressed in Section 8.2.2.1

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Page	**Section**	**Excerpt**	**Contributor**	**Response/Comment**	**Recommended Change**	**Addressed?**	**Comments**
5.57	Report Section Identification : 5.3.2.2		State of Alaska	Comment: The "uncertainties" section just states that the existing criterion may not be protective. It does not state that it also may be overly protective, depending on stream conditions at the mine. Invertebrates in many of the streams may already be impacted by naturally high metals concentrations....or the natural intermittent flow regimes of many of the streams and minor tributaries. Sensitive invertebrate species may not be present. Consideration of only the possible non-protective nature of water quality criteria, without discussion of many, many other uncertainties biases the report. Overall, Section 5.3.2.2 is a very simplified assessment of potential impact. Hence the need for site-specific analysis.		No	The current discussion of Copper Exposure-Response Uncertainties (Page 8-30) presents the same perspective that the copper criteria (water and diet) are likely underprotective, and does not include any consideration that sensitive species may not be locally present or have adapted to the elevated background concentrations related to the natural presence of the copper bearing materials. The section continues to be over-simplified and failures to consider other factors continue to bias the report.
5.59	Section 5.4	1st sentence	ENVIRON	Suggest replacing "often propagate" to "historically propagated"		No	The statement remains unchanged.
5.59	Section 5.4.1	paragraph 1	ENViRON	The cited sources do not adequately evaluate the failure rates of culverts installed to modern standards.		No	The information used to report on culvert failure was unchanged. The only indication provided in the document of modern standards is in the statement, "Although culverts would be designed to certain specifications (Box 10-2), they are not always installed correctly or do not stand up to the rigors of a harsh environment, as indicated by the failure frequencies cited in Section 10.3.2.1." (pages 10-27 to 10-28). The analysis continues to overestimate the likely impacts of culverts by assuming they will not be correctly constructed.

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Page	**Section**	**Excerpt**	**Contributor**	**Response/Comment**	**Recommended Change**	**Addressed?**	**Comments**
5.61	Section 5.4.4.2		ENVIRON	The impacts described in this section can easily be mitigated through culvert sizing and design and can, therefore, be avoided.		No	The final conclusions indicate that, "Salmonid spawning migrations and other movements may be impeded by culverts in 35 streams, 32 of which contain restricted (less than 5.5 km) upstream habitat. Assuming typical maintenance practices after mine operations, approximately 15 of these 32 streams would be entirely or partly blocked at any time." (page 10-40). The analysis continues to assume that road crossings will not be properly designed or installed. The assumed rate of failure is the rate that occurred under standard practices of the mid to early 20th century and are not the same standards used today. Therefore, the analysis continues to overstate the likely impacts of culverts on fish populations.
5.62	Section 5.4.5		ENVIRON	The first cited document was one of the studies that caused a major revolution in the design and construction of roads. It is no longer representative of expected effects of well-designed and constructed roads on sediment inputs. Modern construction techniques include use of out-sloping, mid-slope culverts, gravel, and other techniques designed to transport dust and sediment to the forest floor where water can be filtered prior to reaching a stream. These treatments are also effective at hydrologically disconnecting the road from the stream network.		No	Although the Gibbons and Salo (1973) was replaced with Hoover et al. (1973), the analysis is still based on out-dated information. The analysis continues to assume current construction methods will not be used; hence the analysis greatly overstates the likely impacts of culverts on aquatic biota.

EPA-7609-0003748_0065

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Page	**Section**	**Excerpt**	**Contributor**	**Response/Comment**	**Recommended Change**	**Addressed?**	**Comments**
5.65	Section 5.4.8		ENVIRON	The section assumes that roads will not be constructed to current standards and Section 404(b) of the Clean Water Act protecting wetlands will not be enforced. The impacts described can be largely, avoided through modern road construction techniques. Unavoidable wetland impacts will be required to be mitigated. The entire text needs to be updated to reflect current standards and regulations.		No	The document continues to assume construction methods that do not meet current standards. As a result, the analysis overstates likely impacts of the project.
5.74	Section 5.4.10		ENVIRON	The section assumes that the road will run immediately adjacent to Illiama Lake. There is a high probability that this will not be allowed. The section also assumes that culverts and roads will be poorly designed and culverts will block fish migration. These impacts can be avoided through implementation of modern standards for road and culvert construction. This section needs to be re-written in light of the requirements that would realistically be placed on the hypothetical project.		No	The same assumptions were made for the revised version. The document continues to assume project design and construction methods that do not meet current standards. As a result, the analysis overstates likely impacts of the project.
5.75	Report Section Identification: 5.5		State of Alaska	Comment: Without some quantification of impacts to fish, it is impossible to quantify impacts to salmon-mediated effects on wildlife. It is not clear that impacts on wildlife would be proportional to impacts on salmon caused by the road because much wildlife can move long distances...as stated in the early sections of the Assessment. No analysis is made of roadway corridor effects on wildlife. This is purposeful, keeping impacts related to salmon, but may underestimate actual risks to wildlife. This could be stated in this section of the Assessment.	Recommended Change: Rewrite the Assessment with site specific information, or allow Pebble Limited Partnership to provide detailed permitting documents, then review/estimate likely impacts to fish and wildlife.	No	The following statement was added to the document "The magnitude of salmon-mediated effects on wildlife, subsistence resources, and indigenous cultures cannot be quantified at this time, and is uncertain." (page 12-16). No expanded analysis was provided. The comment stands.

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Page	**Section**	**Excerpt**	**Contributor**	**Response/Comment**	**Recommended Change**	**Addressed?**	**Comments**
5.75	Report Section Identification : 5.6		State of Alaska	Comment: The text states that any negative impact on fish could lead to negative impact on the health and welfare of Alaska Natives. Yet, of the 40,000,000 (high range) fish returning to the Bristol Bay region, it was stated earlier that approximately 150,000 are taken for subsistence. The assessment assumes that "any" impact to fish populations would necessarily result in a proportional impact to Alaska Native subsistence fish use although the relative taking of subsistence fish is small relative to the taking of commercial fish.	Recommended Change: Present a more detailed or at least report more precisely the numbers of salmon used for subsistence versus the total number of fish, and discuss the balance that could be adjusted between escapement, commercial, and subsistence fish harvest, particularly if a more detailed economic analysis shows the mine is more economically valuable than slight losses to the commercial fish industry.	No	The following statement was added to the document "The magnitude of salmon-mediated effects on wildlife, subsistence resources, and indigenous cultures cannot be quantified at this time, and is uncertain." (page 12-16). No expanded analysis was provided. The only value placed on subsistence fishing is an annual harvest of 2.6 million lbs per year (page 5-24), and on average, 50% is Pacific salmon (page 5-34). Additionally, page 5-35 and 5-36 presents % harvest by species for subsistence fisheries in Bristol Bay watershed. The comment stands. The analysis overestimates the impacts on subsistence use.
6.2	Section 6.1.2.3		ENVIRON	By definition, a risk characterization addresses the probability of occurrence. This section needs to discuss the low probability of a tailing dam failure event and the low probability that no remediation would be undertaken should the improbable event occur. Given the low probability of both, the risk to the resource is relatively low. We refer the authors to their own guidance on ecological risk assessment.		No	The current analysis does not incorporate the probability of occurrence into any estimates of definitive risk. The document fails to meet EPA guidance for risk assessment.

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Page	**Section**	**Excerpt**	**Contributor**	**Response/Comment**	**Recommended Change**	**Addressed?**	**Comments**
8.1	Report Section Identification: 8.1.1 Routine Operations		State of Alaska	Comment: Bullet number 2 of the list at the bottom of page 8-1 and continuing to the top of page 8-2 characterizes a loss of streamflows and then alludes to a reduction in production of salmon and resident species. This allusion is a mischaracterization of the overall assessment of risk, in that loss of fish production was not directly quantified, but the loss was indirectly quantified through potential losses in fish habitat (see section 8.5 concerning uncertainties and use of fish habitat loss as a surrogate for loss of fish production). This mischaracterization needs to be checked throughout the document for consistency.	Recommended Change: Throughout the document, remove all statements that characterize the risk in terms of loss of fish production and ensure all statements of risk are in terms of potential loss of fish habitat in keeping with the uncertainties presented in Section 8.5 – bullet 5.	No	Revised document states in Chapter 8 pg. 8-55, 3rd full paragraph: 'Because available data do not quantify fish production in the potentially affected reaches, it is not possible to estimate the lost production of salmon, trout, Arctic grayling, or Dolly Varden. However, the semi-quantitative surveys performed for the EBD (PLP 2011) and summarized in Section 7.1 provide some indication of the relative amounts of fish potentially affected.' However, the document continues to use production as a measure. The document needs to capture that uncertainty and address the range of possible impacts. Currently, the document seems to make assumptions that maximize the expected impacts of a project.
32.36	Report Section Identification: Appendix A, Threatened and endangered salmon and conservation priorities		State of Alaska	Comment: This section does not seem relevant to the stated scope of this assessment. There are no endangered species of salmon in Alaska, including Bristol Bay. Policies in regulation (e.g., 5 AAC 39.222, 5 AAC 39.223) and philosophy of assessing and managing the State's salmon stocks as dictated in statutes and the State Constitution provide mechanisms to detect and be proactive to address dramatic declines in salmon abundance.	Recommended Change: Delete Pages	No	Not addressed

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	Appendix G		ENVIRON	While numerous citations are provided in Appendix G, the appendix does not reflect current construction standards for roads and culverts. In the past couple of decades, great stride have been made in the development of BMPs that substantially reduce runoff from roads and the standards for culverts have changed such the probability of washout has become minimal, culverts are sized to permit both upstream and downstream migration and are also sized to permit movement of debris under the road. Most of the impacts described in this Appendix are easily avoided or mitigated using modern construction methods and standards. Documents that address the effects of historical construction techniques are not pertinent. Although the document indicates that literature documenting the effectiveness of BMPs could not be found, there is actually a very large number of documents available that address BMP effectiveness. Suggest removing all citations and discussion that is based on historical construction techniques and focus discussion on current standards.		No	the appendix continues to assume that project design and mitigation will not meet current construction standards and mitigation requirements under state and federal regulations. Therefore, the assessment overstates the likely impacts of a project.
	Report Section Identification : Chapter 5,6 and 7		State of Alaska	Comment: EPA discusses impacts on fisheries from normal operations and the probability of tailings dam failures and potential negative impacts from single and multiple mines, but fails to compare those statistics with probabilities of other potential negative impacts such as disease, blights, drought, or over-fishing. Consequently, there is no frame of reference for understanding the magnitude of the risk.		No	An adequate assessment of project risk to salmon is not included in the document.

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AA.9	Appendix A	Chum Salmon P2	ENVIRON	This statement not clearly supported by 2 tables on referenced pages which show Nushagak area harvest vs. Nushagak River escapement. Unclear the point of this generalization from one year of data.		No	Not addressed. One year of data is insuffient to support the statements in this section.
2.16	Report Section Identification : Section 2.2.3		State of Alaska	Draft Comment: Text states that the Mulchatna caribou herd spends a considerable amount of time in other watersheds. Approximately how much time does the Mulchatna caribou herd spend in the Nushagak and Kvichak River watersheds?	Draft Recommended Change: Specify how much time the Mulchatna caribou herd spends in the Nushagak and Kvichak River watersheds as compared to other watersheds in the Bristol Bay watershed. This information might be presented as a fractional use estimate.	No	Identical text.
2.25	Section 2.3.5		ENVIRON	There were no discussions of natural causes of stream blockages or other catastrophes that would impact on specific genetic stocks or the diversity of stocks. This would have set the existing condition stage for potential impacts from proposed hard rock mining activities.		No	Comment not addressed. All factors potentially affecting fish populations need to be incorporated into a proper risk assessment. The document consistently fails to address the actual expected effects on fish populations.

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3.5	Section 3.5		ENVIRON	This assessment is not a predictive model as it portrays itself to be. This assessment simply illustrates what might happen, but presents it as a predictive warning. This is illustrative in this section. The second line of evidence focuses on past mining in the area. This may be a good line of evidence if not for the fact of how much mining has changed in past few years, much less decades in the technology and methods of hard rock mining. The report uses these types of evidences as a frame work to analyze risk from any activity proposed in the Bristol Bay area; however, no project design nor project efforts to avoid, minimize or mitigate by design or by technological advance have ever been proposed.		No	Text added to beef up their rationale, however the text continues to assume that historical mining practices would be implemented on a new project and that mitigation that would be required under state and federal regulations would not be implemented. Therefore, the analysis overestimates the likely project effects.
5.16	5.2.1.2 and Appendix C		ENVIRON	The assessment states that the loss of upstream waters (p 5-21, P 1) would " greatly reduce inputs of organic material, nutrients, water, and macro invertebrates to reaches downstream ....". They also state that 65% of the nitrogen flux is attributed to headwater contributions. They then go on in Appendix C (p 16-18) to state the tremendous importance of Marine-derived Nutrients to the Bristol Bay Watersheds coming in from salmon swimming upstream.		No	Marine derived nutrients are a primary source of nutrients in the river, as is indicated in the Appendices. The main body of the text needs to reflect this. The document seems to assume that headwaters are a driving source of nutrients and no nutrient budget has been developed. The analysis likely overestimates the effects of reductions in nutrients from headwater streams.

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5.16	5.2.1.2		ENVIRON	Organic inputs and nutrients from areas upstream of the proposed mine site are unlikely to provide a vast quantity of materials to downstream third and fourth order streams. Drifting macroinvertebrates directly downstream might diminish to a degree, but the amount of the reduction wo8uld be a direct result of the footprint size and location, and what types of vegetation etc., would be removed, and through avoidance, minimization and mitigation techniques, this could be contained to a minimal impact.		No	Marine derived nutrients are a primary source of nutrients in the river, as is indicated in the Appendices. The main body of the text needs to reflect this. The document seems to assume that headwaters are a driving source of nutrients and no nutrient budget has been developed. The analysis likely overestimates the effects of reductions in nutrients from headwater streams.

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5.53	Report Section Identification : 5.3.2		State of Alaska	Comment: This section is a simple risk-based screening comparing average untreated waste rock leachate metals concentrations to water quality criteria. This assumes 100% exposure of all aquatic species in all streams. The results were a predicted potential for risks due to aluminum, copper, and zinc, with the greatest indicated concern being copper. Using the biotic ligand model significantly increases the predicted risks for copper. The screening concentrations predicted by the biotic ligand model are strongly related to the amount of organic material in the water. The assessment set dissolved organic carbon to 1 mg/L but provided no specific reasoning as to why, other than that dissolved organic carbon is expected to be low and 1 mg/L was the lowest possible in the model calculations. Background levels of dissolved organic carbon were measured in the Pebble Limited Partnership Environmental Baseline Data to be approximately 1.5 mg/L. Regardless, the screening suggests the potential for effects to aquatic life if untreated waste rock leachate were discharged to streams.	Recommended Change: Clearly justify use of 1.0 mg/L dissolved organic carbon. Discuss or provide evidence of how toxicity may change downstream as concentrations of metals decrease and organic matter concentration likely increases. May be able to use data from Pebble Limited Partnership Environmental Baseline Data as dissolved organic carbon was measured, and in the North Fork Koktuli ranged from 0.5 to 4.55 mg/L	No	No further justification is provided concerning the use of 1.0 mg/L DOC (which is not the lowest value that can be entered in the model available from HydroQual, which is actually 0.05 mg/L). The exposure conditions related to the development of the BLM values are also not provided in the document, preventing any review or independent evaluation of these numbers used in the calculation of risk quotients.

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Page	**Section**	**Excerpt**	**Contributor**	**Response/Comment**	**Recommended Change**	**Addressed?**	**Comments**
5.53	Report Section Identification : 5.3.2.2		State of Alaska	Comment: This analysis of copper toxicity shows that the biotic ligand model provides a "protective" risk-based screening concentration. This method is likely overprotective as calculated because of the sensitivity of stream invertebrates used to develop the model/criteria. A site-specific investigation could provide a more accurate and meaningful evaluation of water quality criteria that would be protective of aquatic life.		No	This comment is not reflected in the current review draft
5.74	Section 5.5		ENVIRON	This section assumes that impacts described in previous section on fish will occur. The prior comments on those sections need to be addressed and this section needs to be re-written in light of the analysis errors in the prior sections.		No	The same assumptions were made for the revised version.

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6.45	Section 6.5		ENVIRON	Only ten lines are dedicated in the text to detailing the effects on wildlife following a failure. This alone should illustrate the lack of data and correct analysis. There are no scenarios for the size of the "projected failure", nor the timing of such failure. Current mining methods and practices have greatly reduced the potential of said failures. The magnitude of said failure would greatly influence an impact analysis on wildlife. Additionally, the conceptual models and the endpoint of such models have not adequately taken into account the diverse habitat range of higher order predators, and a failure that might result in an impact to one stream, may have no significant impact on species who can forage from within a very large home range. Further, the authors state "all terrestrial wildlife in the Bristol Bay watershed depend upon the enhanced aquatic and terrestrial production provided by the marine nutrients that are brought into the watershed by returning and spawning salmon." This a very large, un referenced, un substantiated statement intended to lead the reader to think that if any of the salmon carried nutrients were to be blocked in anyway from reaching these upper streams, then all terrestrial wildlife would be impacted.		No	Scenarios for the size of the projected failure and expanded text are added but the comment was not addressed. The assessment of wildlife effects is therefore incomplete.

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28	Appendix C		ENVIRON	An example of one of the weaknesses of predictive models that are not validated with local data is presented on this page. The brown bear population estimates are extrapolated from population densities in other watersheds. This approach (applied to any wildlife species) can severely under or over estimate population densities.		No	Not addressed. The document should at a minimum discuss the sources of uncertainty and the effects of that uncertain on the assessment.
	Appendix C		ENVIRON	The characterization of the resource seems complete. However, Appendix C has some flaws: 1) the methodology is based on one endpoint, salmon. 2) the assessment emphasizes the importance marine derived nutrients, yet also says that nutrients derived from headwater streams are a driving factor in nutrient load and distribution in the terrestrial environment, 3) the "predictive risk assessment include(s) inherent uncertainties" - these uncertainties are unfounded and based upon worst case scenarios, often from mining methods and techniques that are no longer used; some of which occurred over a century ago.		No	The assumption that nutrients derived from headwaters are a significant source in a basin supporting large salmon populations are unfounded. As a result of the assumption, impacts are overstated. In addition, the assessment quality is affected by assumptions regarding mine design and assumptions that mitigation would be largely lacking.
4.4	Section 4.4.2	paragraph 1	ENVIRON	The international examples of failures are likely not relevant given the differences between US standards and standards in the cited countries.		No	These examples are still included in the discussion provided in text box 9-1. Comparison to international mines that may or may not have been constructed to current US standards with current US mitigation requirements is inappropriate and should be removed from the document. These comparisons imply effects that are greater than would likely occur under current US construction, design, and mitigation standards.

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Page	**Section**	**Excerpt**	**Contributor**	**Response/Comment**	**Recommended Change**	**Addressed?**	**Comments**
4.4	Report Section Identification: Chapter 4.4.2		State of Alaska	Comment: EPA implies that because the tailings dam heights used in the mine scenario are very large, the impacts of a failure would be much greater than the historical failure record from much smaller dam failures. Box 4-4 lists four examples of tailings dam failures, including the 2008 flyash pond failure at the Kingston Power Plant in Tennessee. All of the dams described are less than 30 meters high, and all have questionable design and operational histories. EPA fails to acknowledge that tailings dam failure statistics are biased by the failure incidents of such small dams, because there have been no catastrophic failure of large dams approaching the scale of the mine scenarios used in the Assessment.		No	While the text acknowledges that there is no examples of large dam failure, the consequences of such a failure are still presented in the assessment., extrapolating from the failures of much smaller dams which, as the reviewer pointed out, all have questionable designs and operation histories. It is difficult to find any comparability between these examples and any proposed tailings facility that would be conducted in this watershed.

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Page	**Section**	**Excerpt**	**Contributor**	**Response/Comment**	**Recommended Change**	**Addressed?**	**Comments**
4.41	Box 4-4	Aurul S.A. Mine, Baia Mare, Romania, 2000. A 5-km-long, 7-m-high embankment on flat land enclosed a tailings impoundment containing a slurry with high concentrations of cyanide and heavy metals. Heavy rains and a sudden thaw caused overtopping of the embankment, cut a 20- to 25-m breach, and released 100,000 m3 of contaminated water into the Somes and Tisza Rivers. Flow continued into the Danube River and eventually reached the Black Sea. The contamination caused an extensive fishkill and the destruction of aquatic species over 1,900 km of the river system (ICOLD 2001).	Knight Piesold	This is an example of poor operation and inadequate regulations for an operation in Romania. The failure resulted from overtopping which caused rapid erosion and failure of an erodible cyclone sand tailings dam. Is EPA implying that the USA standards, regulations and enforcement protocols are comparable to the Romanian 'standards'?		No	The Baia Mare example is still included in Box 9-1 "Examples of Historical Tailings Dam Failures." The failure was attributable to poor choices of dam materials, improper consideration of maximum precipitation events in the facility design, and the results of an actual maximum precipitation event. It is difficult to find any comparability between Baia Mare and any potential rockfill tailings facility constructed in this watershed and subject to State of Alaska permitting requirements.

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Page	**Section**	**Excerpt**	**Contributor**	**Response/Comment**	**Recommended Change**	**Addressed?**	**Comments**
4.41	Box 4-4	References to "dam failure" in EPA document: 186 times (including headings, figures, and appendices)	Knight Piesold	The report places heavy influence on dam failure, and illustrates, that at a minimum, there is a fundamental anti development bias. The EPA study relies heavily on the premise that 'it is not a matter of IF but WHEN tailings dam failure will occur'. They attempt to justify this premise by repeatedly asserting that failure 'could' occur and by quoting several technical papers out of context.		No	While the text acknowledges that there is no examples of large dam failure, the consequences of such a failure are still presented in the assessment. The assessment needs to incorporate standard risk assessment procedures to characterize the overall risk to the environment.
4.44	Section 4.4.2.2	both paragraphs	ENVIRON	The use of the tailing dam failure information worldwide from 1917 to 2000 is inappropriate. A large proportion of the failures were likely due to construction that did not incorporate modern standards used in the US. This analysis should be revised using only data from sites that were constructed to modern standards.		No	Not addressed; references to 1917 remain. Use of mines developed to standards that are less that those that would be implemented at a new mine as examples of expected impacts is inappropriate. The failures and impacts of historical mines and mines developed outside of the US are not reflective of the impacts that would be expected at a mine that is developed to meet today's standards. Use of these examples results in a substantial overstatement of likely project effects.

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Page	**Section**	**Excerpt**	**Contributor**	**Response/Comment**	**Recommended Change**	**Addressed?**	**Comments**
4.44	Report Section Identification: Chapter 4.4.2.1		State of Alaska	Comment: The Assessment indicates that overtopping is one of the leading causes of inactive tailings dam failures. However, this data is biased because the sample population includes a number of failures of dams with inadequate spillway designs. Any large or very large tailings dam in Alaska must be designed to accommodate the Probable Maximum Flood (PMF) during operations, and safely pass the PMF through a properly designed spillway in closure. Note that the PMF is a misnomer, in that there is no specific probability associated with the event since it represents the result of the most severe meteorological and hydrologic event that is reasonably possible at a given site. The argument that a large or very large tailings dam built in Alaska would be particularly susceptible to failure due to overtopping based on historical evidence of international tailings dam failure incidents is systematically flawed.		No	The document now states that "Although a tailings dam failure is a low-probability event, the probability is not zero. Should such an unlikely event occur, it is important to understand the potential impacts on the Bristol Bay watershed." While the text acknowledges that there is a low probability of overtopping leading to failure, the consequences of such a hypothetical failure are still presented in the assessment.
4.45	Report Section Identification: Chapter 4.4.2.2		State of Alaska	Comment: EPA states, "Low failure frequencies and incomplete datasets also make any meaningful correlations between the probability of failure and dam height or other characteristics questionable. Very few existing rockfill dams approach the size of the structures in our mine scenario, and none of these large dams have failed." Nevertheless, EPA continues in their conjecture to presume that the tailings dam fail during both the operation and post-closure phases of the mine.		No	This statement is still included in the revised document; the incongruity between the authors' statement (which acknowledges that no large dams have failed) and the presumption of catastrophic failure in their theoretical dam scenario has not been resolved.

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Page	**Section**	**Excerpt**	**Contributor**	**Response/Comment**	**Recommended Change**	**Addressed?**	**Comments**
4.45	Report Section Identification : Chapter 4.4.2.2		State of Alaska	Comment: The EPA presents statistics on dam failures and gives an upper bound of one failure per approximately 2,000 mine years. However, the EPA fails to describe whether the respective failures had any adverse impact on the environment. For example, a slope stability type dam failure may be reported, but not necessarily have resulted in any adverse impact on the environment downstream of the dam		No	The report uses the same approach in the second version as the first - assessing probability of failure, assuming it to be catastrophic, and then basing the environmental impact on the size of the TSF1 facility. The use of standard risk assessment approaches to evaluating potential environmental effects would improve the document. As is stands, the document overestimates the likely project effects.
4.49	4.4.2.3	In our mine scenario, TSFs would be enclosed by rockfill dams constructed primarily of well-graded, non-acid-generating waste rock obtained from the mine pit during operations; the starter dike would contain material excavated from the upstream toe trench and local quarry.	Knight Piesold	The construction method varies with a rockfill or earthen (borrow material) starter dam. Also if the model is clearly constructed from rockfill, why are failure mechanisms prevalent for upstream sand dams considered? EPA discussion about their assumed dam design/construction at Pebble is inconsistent with their discussions about their interpretations of the risk of dam failure.		No	The report contains essentially the same analysis for this topic as was presented in the first draft of the assessment. Comment was not addressed.

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6.1	Report Section Identification : Chapter 6		State of Alaska	Comment: Current practice across a broad spectrum of engineering and industry for risk management is to conduct a form of risk evaluation referred to as a Failure Modes and Effects Analysis (FMEA). The FMEA process is used to identify and focus in on aspects of the design with the highest relative probability of failure and the greatest consequences. An integral part of an FMEA is the identification of mitigation measures that must be implemented to ensure that any failure modes for which there is a significant consequence and risk are mitigated to the extent necessary to reduce risk to tolerable limits. These aspects are then reviewed in additional detail and measures to mitigate the risk by reducing the probability of failure are designed into the feature. For significant projects, the risk evaluation may be advance to a formal engineering risk assessment that quantifies the risk in more detail. The Assessment fails to recognize these basic risk management tools.		No	There is no evidence that FMEA was considered in the second draft of the document.

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Page	**Section**	**Excerpt**	**Contributor**	**Response/Comment**	**Recommended Change**	**Addressed?**	**Comments**
6.1	Report Section Identification : Chapter 6.1		State of Alaska	Comment: The dam failure analysis assumes an extreme event while the probable maximum flood (PMF) is occurring, and that the dam failure is the worst possible (a full breach of the dam), and the breach results in loss of the maximum reasonably anticipated amount of tailings (20%). This is at the extreme limit of possible concurrent consequences, and the absolute worst for salmon impacts. The likelihood of the PMF is extremely low. High hazard dams are all equipped to contain or pass the PMF. Hence there is also an extremely low probability that the dam will fail if the PMF did occur. There are also a number of failure consequences other than the extreme consequence of a breach and 20% tailings discharge, should 'a failure' occur. Thus the combination of a failure of this particular type with this particularly severe consequence is a very special case of failure with a probability much, much less than the failure probability derived from historic dam failure records. No examples of A failure of a tailings dam constructed by the downstream method with a height of over 150 meter under any circumstances are in recent literature.		No	While the current draft does indicate that there is no record of failure for dams of the size evaluated here, it nonetheless presents the same catastrophic failure scenario (full breach) as was evaluated in the first draft. The comment stands. As a result the document continues to overstate likely project impacts.

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Page	**Section**	**Excerpt**	**Contributor**	**Response/Comment**	**Recommended Change**	**Addressed?**	**Comments**
6.1	Report Section Identification : Chapter 6		State of Alaska	Comment: The EPA assessment appears not to recognize the FMEA process or the benefits and consequences of applying the FMEA process and subsequent requirement for the implementation of the risk reduction measures to reduce risks to acceptable levels. Certainly the generic treatment of a 'mining scenario' which has not been thoroughly tested and optimized through the application of the FMEA and risk mitigation, together with the extreme size and extreme consequences assumed in the assessment results in a biased and unrealistic characterization of the true risk.		No	The comment stands. As a result the document continues to overstate likely project impacts.
6.1	Report Section Identification : Chapter 6.1.2.4		State of Alaska	Comment: Section 6.1.2.4, Uncertainties, indicates that while it is "certain" that a tailings dam failure would have "devastating effects", the "timeframe for geomorphic recovery" could be "decades". However, given that EPA has assumed that because of the infinite life of the project that the dam has failed, a consistent perspective would be to assume that several decades for recovery from a very low probability event is a relatively short period of time over infinity.		No	The comment that dam failures would have "devastating effects" remains in the document, although the analysis does provide a more detailed explanation of how the tailing dam failures assessment was performed is provided. The document does not adequately address risk of failure.

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6.29	Report Section Identification : 6.1.6		State of Alaska	Comment: A catastrophic TSF dam failure would seem to be the most significant impact to the environment. However, given the lack of definition of the probability and likely actual size of a potential spill under the hypothetical mine scenario, the conclusions stated in this section are likely overstated.	Recommended Change: Some understanding of the assumptions should be summarized here in summary form to give readers. The text should reflect that under the hypothetical assumptions it seems the described result would occur but under different conditions, a different level of impact would occur.	No	No estimation of the probability of occurrence has been incorporated into this text as it is currently presented in the second external review draft. The comment stands.

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6.30	Report Section Identification : 6		State of Alaska	Comment: These pages address the potential effects of a concentrate spill in the transportation corridor, with its many stream crossings. Page 6-30 states that a concentrate spill would be limited to 475 cubic meters due to automatic shutoff, and it states that all or part of this mass could enter the stream. If the concentrate slurry volume is 475 cubic meters, the concentrate itself is probably 50% of that amount. It is stated that a concentrate spill into a stream or wetland would result in acute exposure of fish and invertebrates to toxic water. This is very doubtful for a few reasons: 1) the slurry concentrate consists of approximately 50% water (at a pH of likely greater than 7.0), and sulfides of copper as chalcopyrite, some pyrite and bornite. These minerals take a significant time, probably years, to fully oxidize and produce acid. The assessment does not consider that there will be time to clean up the concentrate spill before any major oxidation would take place. There may still be some stream damage or wetland damage but it is not likely that toxic water would be present, 2) There is also no mention that the vast majority of the length of the pipelines is on land and may never reach a stream and 3) the concentrate is very valuable and the Company will have a major economic incentive (as well as permit requirements) to clean up any spills to the best extent possible.	Recommended Change: Present a more unbiased view of the likelihood of a concentrate spill entering a stream and discuss that the oxidation of the sulfides occurs at a potentially very slow rate, thus lessening the impacts to water quality over time. Also, these impacts could be mitigated by requiring a detailed Spill Mitigation Plan in the permit process.	No	This comment is not reflected in the current review draft. The comment stands. The impacts of a concentrate spill do not accurately reflect actual expected impacts.

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All	Report Section Identification: Executive Summary and Throughout		State of Alaska	Comment: In regard to the impacts of the proposed mine on streams and fish, the Bristol Bay Watershed Assessment is too general to determine actual impacts of the proposed mine.	Recommended Change: A detailed and site-specific EPA review of the Pebble Limited Partnership (Pebble Limited Partnership) Environmental Baseline Document (Pebble Limited Partnership Environmental Baseline Data) and application of their considerable data to the issues raised by EPA in the Bristol Bay Watershed Assessment would have gone much further to understanding the actual impact.	No	Comment stands.

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All	Report Section Identification: Executive Summary and Throughout		State of Alaska	Comment: No one can refute that some level of impacts to fish, wildlife, and their habitat(s) will result if the mine is built and operated for many years. The question is "what are the risks". The Bristol Bay Watershed Assessment repeatedly emphasizes the "possible" effects, but other than the simple risk based screening of average leachate concentrations to water quality criteria, there is essentially no other site-specific assessment of the impacts to species and the quantification of lost habitat. The conclusions are oversimplified to the extent that it is not applicable to individual species or their populations. Pre-emptive action by the EPA in an area designated by a state as a potential mining area is unprecedented.	Recommended Change: Pebble Limited Partnership has collected a massive amount of relevant site-specific data, made public in their Pebble Limited Partnership Environmental Baseline Data, that has not been incorporated into any ecological risk assessment of the potential mine impacts. Unless there is a pre-emptive political decision to disallow development of the mine because of the "pristine" nature of the Bristol Bay Watershed, then Pebble Limited Partnership should be allowed to use their data to develop a mine development and management plan, and a risk assessment/mitigation plan for the proposed mine. Then, agencies responsible for environmental impact and permitting review can better assess the degree of impact and either request further mitigation/assurances or deny the permit. Or, if the EPA wants to continue engagement in this process, then they could do the site-specific study, but it would seem that any EPA work would then have to be subject to interaction and review by the permittee.	No	Comment stands. Available data has not been used in the analysis and the analysis methods do not adequately address risk.

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All	Report Section Identification: Executive Summary and Throughout		State of Alaska	Comment: The Pebble Limited Partnership Environmental Baseline Data provides a substantial amount of site-specific data and detail, but the data have not been incorporated into a risk assessment type of document, as likely would be done through the permitting process. On the other hand, the Bristol Bay Watershed Assessment does a risk assessment with essentially no site-specific data. Neither the Pebble Limited Partnership Environmental Baseline Data nor the Bristol Bay Watershed Assessment allows a clear understanding of the potential risks to the environment, fish, wildlife, or Alaska Natives.	Recommended Change: The details provided in the Pebble Limited Partnership Environmental Baseline Data and other site-specific documents must be used to more accurately and more elaborately evaluate and predict risks.	No	Comment stands. Available data has not been used in the analysis and the analysis methods do not adequately address risk.

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All	Report Section Identification: Executive Summary and Throughout		State of Alaska	Comment: Throughout much of the document, the normal approach to technical reporting is reversed. Rather than starting a section or subsection with an understanding/discussion of the issues to be addressed then addressing/evaluating the issues before reporting results of the evaluation, the Bristol Bay Watershed Assessment provides conclusive statements in the introduction to many, if not all sections and subsections. In some cases these conclusions are completely unsubstantiated in the following subsections. In other cases, there are some simple to extremely incomplete analyses that appear designed solely to support the conclusions stated in the introductory paragraphs. It is as if the report is written to convince people of the opinions of the authors, without the level of detail or evaluation necessary to support the conclusions. It is disconcerting to see this in a Technical Document from the USEPA.	Recommended Change: Do not rely on the Bristol Bay Watershed Assessment as a technical document. Rather, allow technical documentation to be developed by the applicants with good data and detailed analysis. Use the detailed analysis and evaluation to evaluate the likely impacts of the Pebble Mine.	No	A perusal of the 2013 document appears to substiate the commentator's claims in regards to initiating sections with statements of impact (e.g. Section 9.3; Section 10.3). Generally the language of the original draft has been retained despite substantial reorganization. There is nothing in the document that suggests that this comment has been substantially addressed.
ES.23, Fish.Mediated Risk to Indigenous Culture	Report Section Identification: Executive Summary		State of Alaska	Comment: The impacts to fisheries resources that consequently impact indigenous cultures, does not include assessment of secondary mine development and infrastructure (towns, roads, utilities, social-political impacts). These secondary mine development and infrastructure could have the potential to be as significant an impact on indigenous cultures as the mine-to-fish impacts on indigenous cultures.	Recommended Change: An expanded mine scenario should be included to include secondary mine development and infrastructure and associated impacts to understand the full scope of cumulative effects.	No	It appears that this comment has not been addressed. This section (page ES-25) is nearly the same as in the previous document. No reference to an expanded mine scenario or secondary mine developments was discovered in the full document.

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ES.26, bullet 3, last sentence	Report Section Identification: Executive Summary, Summary of Uncertainties and Limitations in the Assessment		State of Alaska	Comment: Overly simplistic to believe that "Estimated effects of mining on habitat become the available surrogate for estimated effects on fish populations." There are many examples showing fish habitat is not a good measure of fish abundance or populatio n dynamics.	Recommended Change: Consider including ways to assess and/or gather insights into fish abundance and population dynamics that are less cumbersome than those stated in the report and better than habitat surrogate.	No	pg 14.14 first bullet, the paragraph in question remains unchanged with no evidence that the comment has been addressed.
5.59	5.4	Section 5.4, Page 5-59, Paragraph 1, First Sentence: "*Only rarely can roads be built that have no negative effects on streams (Darnell et al. 1976).*"	HDR	Design for low impact roads which address sedimentation, erosion, flood, and habitat concerns have progressed since 1976. "The U.S. Forest Service, the National Park Service, the USDA Natural Resources Conservation Service, California Department of Forestry and Fire Protection [CDFG], and many forest and ranch landowners have all endorsed some form of the road design approach commonly referred to as 'Low Impact to Hydrology' (LITH). The goal of the LITH design approach is to make roads less disruptive to natural watershed runoff processes" (Dashiell and Lancaster n.d.). Techniques used in LITH road design are outlined in Road Design Guidelines for Low Impact to Hydrology (Dashiell and Lancaster n.d.) as well as Roadway Design Guidelines: Pacific Region (USFWS 2011). These techniques are known to significantly reduce the effects of road construction on ecological resources.		No	There was no inclusion of the LITH road design in the document. It was assumed that road construction would follow the ADEC BMPs. Other BMPs can be employed to reduce impacts of roads.

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5.59	5.4.1	Section 5.4.1, Page 5-59, Paragraph 1, First Sentence: "*Culverts are the most common migration barriers associated with road networks*."	HDR	Culverts designed using modern design guidelines developed by ADOT&PF, CDFG, NMFS, USDA, FHWA, Washington Department of Fish and Wildlife (WDFW), and others have been be constructed that allow aquatic and terrestrial organisms unhindered movement up and down aquatic corridors such as streams and rivers. Examples of such installations have been constructed within the Municipality of Anchorage, Matanuska-Susitna Borough, and Kenai Peninsula Borough, and are supported with funds from the U.S. Fish and Wildlife Service and are permitted by the various resource agencies.		No	Modern standards are discounted in the statement, "Although culverts would be designed to certain specifications (Box 10-2), they are not always installed correctly or do not stand up to the rigors of a harsh environment, as indicated by the failure frequencies cited in Section 10.3.2.1." (pages 10-27 to 10-28). Box 10-2 provides information on culvert mitigation provided in the MOA between ADOT and ADF&G (a 2001 document). Due to the assumption that modern standards will not be implemented correctly, the document overstates likely iimpacts.

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5.59	Report Section Identification : 5.4 Roads and Stream Crossings		State of Alaska	Comment: The opening section has several general and broad sweeping statements regarding roads impacts on stream and river conditions. In particular, the statements are phrased such that it implies roadway impacts are broad and can propagate significant distances upstream and downstream. The following statement needs some sideboards "The physical effects of roads on streams and rivers often propagate long distances from the site of a direct road incursion, as a result of the energy associated with moving water (Richardson et al. 1975)." For instance, a culvert located on a steep stream (say greater than 6% slope) will not likely have extensive (several kilometer) upstream and downstream effects on the stream and floodplain due primarily to the steep valley slope. and road crossings on flat, alluvial channels and floodplains could potentially affect and impact streams for significant distances upstream and downstream.	Recommended Change: Rephrase sentence to emphasize that improperly designed road crossings	No	Section 10.3.2 The sentence remains essentially unchanged but for a clarification of 'actual stream crossing': The physical effects of roads on streams and rivers often propagate long distances from actual stream crossings, because of the energy associated with moving water (Richardson et al. 1975). There is no further discussion of the improper versus properly designed culverts, so the comment has not been addressed.

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5.59	Report Section Identification: 5.4 Road and Culvert Failures, Stormwater Runoff		State of Alaska	Comment: The narrative implies that only roads can have negative effects on stream passage. Flood events can have substantive changes in the natural stream environment in regards to 'modification of drainage networks, acceleration of erosion processes, which, in turn, can lead to changes in streamflow regimes, sediment transport and storage, channel bank and bed configurations, substrate composition, and the stability of slopes adjacent to streams.' The assumption that roadway salts would be used for general winter maintenance is a considerable jump. BMPs for roadway maintenance in winter climates depend largely on the temperatures, existing road surface, type and rate of vehicle travel, and other considerations. In colder climatic conditions, salts are not utilized for winter maintenance. If salts/brines are used for winter maintenance they are typically used on paved roadways. Given the heavy vehicle traffic this road would carry, this writer assumes a non-paved surface for the major roadways.		No	A discussion of floods is only addressed in relation to release of tailings slurry, culvert failure, or climate change. There is no discussion of natural sedimentation and transport processes in the watersheds, other than increased streamflow will induce higher rates of sediment transport. The assumption that salt would be used for winter maintenance remains in the document.
5.59	Report Section Identification: Main Report, Section 5.4, Roads and Stream Crossings		State of Alaska	Comment: The assumptions regarding the number of culverts and bridges may be inaccurate. On numerous occasions, ADF&G has communicated to the Pebble Limited Partnership the desire for bridges at all stream crossing locations. Bridge designs, not culverts, will be the starting point for each considered road crossing.	Recommended Change: The watershed assessment should reflect ADF&G's preference for bridges instead of culverts and the roadway risks/impacts discussion should focus on possible effects of bridges on stream habitat and fish resources.	No	It was assumed that crossings over streams with mean annual flows greater than 0.15 m3/s would be bridged and the remaining culverted. There was no indication in the document that ADF&G prefers that all stream crossing locations be bridged. The risk characterization still focusses on culvert crossings.

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5.59	Report Section Identification : 5		State of Alaska	Comment: The pages state that the transportation corridor crosses 34 streams and rivers. As stated in the Executive Summary "The most likely serious failure associated with the transportation corridor would be blockage or failure of culverts". This is readily avoided through either small bridges or very large culverts or a series of culverts designed to handle extremely large events. Given the sensitivity of the rivers and streams to the fisheries, the company should be required to build long lasting crossings that would not plug up. It will cost additional money to build these crossings but they would avoid the type of plugging impacts discussed on these pages.	Recommended Change: Add language that these impacts would most likely be avoided in the permit process by requiring significant long lasting crossing designs.	No	The analysis still assumes that culverts will be primarily used, and the information on blockages and failures remains largely unchanged in the document.
5.6	5.4.1	Section 5.4.1, Page 5-60, Paragraph 1, Last Sentence: "*Although the well-planned installation of culverts allows natural flow upstream and downstream of crossings, failure rates are generally high (Sections 4.4.3.3 and 6.4).*"	HDR	Modern culvert design standards foster designs that are self-sustaining, durable, and provide continuity of geomorphic processes such as the movement of debris and sediment (CDFG 2009). NMFS design criteria require that all fish passage facilities be designed for the 100-year flood event (2001) and that any potential damage to the crossing be addressed as part of the design process. These design criteria significantly reduce the potential of culvert failure, both blockage of fish passage and road washout, and promote habitat and fluvial process continuity.		No	Modern standards are discounted in the statement, "Although culverts would be designed to certain specifications (Box 10-2), they are not always installed correctly or do not stand up to the rigors of a harsh environment, as indicated by the failure frequencies cited in Section 10.3.2.1." (pages 10-27 to 10-28). Box 10-2 provides information on culvert mitigation provided in the MOA between ADOT and ADF&G (a 2001 document).

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5.61	5.4.4.2	Section 5.4.4.2, Page 5-61, Paragraph 1, Sentence 2: "Culverts pose the most common migration barriers associated with road networks. Persistent barriers to fish movement are assessed in Section 6.4, because they are considered to constitute maintenance failures. Culverts designed to meet the State of Alaska's requirements and regularly maintained should not block fish passage; however, hydraulic characteristics such as low water depth or high water velocities and culvert configurations can impede or prevent fish passage."	HDR	As described in detail in several sources (WDFW 2011, CDFG 2009, USDA 2008, ADOT&PF 2001) modern approaches to culvert design incorporate a continuous streambed that mimics the slope, structure and dimensions of the natural streambed. Water depths and velocities are as diverse as those in the natural channel, providing passageways for all aquatic organisms (USDA 2008) and maintaining sediment and debris continuity. Water depth through culverts is maintained during low flow through incorporation of a constructed channel to concentrate flow and maintain stream thalweg continuity. Design criteria require evaluation of velocities during flows that occur during key migration periods (e.g., low flows) so as not to impede fish passage. Failure in such properly formulated stream crossings is limited and the long term biological benefits of such stream systems can be maintained over time.		No	Modern standards are discounted in the statement, "Although culverts would be designed to certain specifications (Box 10-2), they are not always installed correctly or do not stand up to the rigors of a harsh environment, as indicated by the failure frequencies cited in Section 10.3.2.1." (pages 10-27 to 10-28). Box 10-2 provides information on culvert mitigation provided in the MOA between ADOT and ADF&G (a 2001 document).

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5.61	5.4.4.2	Section 5.4.4.2, Page 5-61, Paragraph 2, Sentence 2: "Culverts can reduce flow to these habitats by directing flow from the entire floodplain through the culvert into the main channel. High water velocities in a stream channel may result from storm flows being forced to pass through a culvert rather than spread across the floodplain. Higher velocities cause scour and downcutting of the channel downstream of the culvert, hydrologically isolating the floodplain from the channel and consequently blocking fish access to floodplain habitat."	HDR	While old and inadequate culvert installations do occur in sensitive habitats across the United States, modern industry design approaches reduce the physical and biological impact to streams and rivers. Chapter 6.5.1.1 of USDA, 2008 describes a number of stream simulation type culvert design strategies which can be used in wide, active floodplain scenarios. These design techniques can be used to protect and/or restore floodplain processes and habitats (USDA, 2008).		No	Modern standards are discounted in the statement, "Although culverts would be designed to certain specifications (Box 10-2), they are not always installed correctly or do not stand up to the rigors of a harsh environment, as indicated by the failure frequencies cited in Section 10.3.2.1." (pages 10-27 to 10-28). Box 10-2 provides information on culvert mitigation provided in the MOA between ADOT and ADF&G (a 2001 document).
5.61	Report Section Identification : 5.4.6.3		State of Alaska	Comment: EPA references the Memorandum of Understanding (MOU) between ADF&G and ADOT&PF as a statewide standard for culvert installation on fish-bearing streams. This MOU is not a statewide standard for all entities; rather, it simply serves as an agreement between the two agencies that establishes a tiered approach to culvert installation and some minimum design requirements.	Recommended Change: The watershed assessment should make it clear that statewide standards for culvert design and installation currently do not exist. ADF&G evaluates each proposed culvert installation on a case by case basis.	No	Pg 10-28 second paragraph, reference to *Standards for culvert installation on fish-bearing streams in Alaska remains*, and Box 10-2, which discusses the MOA, does nothing to emphasize the project-by-project nature of culvert evaluation as mentioned by the commentator. The comment has therefore not been addressed.

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5.62	5.4.4.3	Section 5.4.4.3, Page 5-62, Paragraph 1, Sentence 3: *"The behavioral responses to culverts of the up-migrating and down-migrating life stages of the salmonid species that use the potentially crossed streams are uncertain."*	HDR	The behavioral responses to culverts of upstream and downstream-migrating salmonid species of all life stages are well understood. Modern stream simulation type design techniques evolved from decades of field studies related to culvert passage evaluation. One such example is the document titled Improving Stream Crossings for Fish Passage prepared by the Humboldt State University Foundation for NMFS in 2004. This document emphasizes watershed hydrology, fisheries biology, and culvert hydraulics. The document conclusions are based upon years of monitoring juvenile and adult salmonid passage. Other examples are readily available in the literature.		No	Pg 10-28 second paragraph, the referenced sentence has been modified: *Culverts are not always built to specifications and the behavioral responses of migrating salmonid life stages to culvert-induced changes in flow are not always anticipated correctly.* The wording appears to sidestep the commentator's point about the availability of information on culverts and fish. Furthermore, the suggested reference has not been incorporated. The comment has not been substantially addressed.
5.63	Report Section Identification : 5.4.6.3		State of Alaska	Comment: Says "Additionally, 19.4 km of roadway would intersect wetlands within and beyond those mapped by the National Wetlands Inventory (NWI). Runoff from these segments of roadway could have a significant impact on these wetlands."	Are there any examples or studies that can back up this statement?	No	The statement remains in the revised version, although instead of 19.4 km they provide a figure of 12 km of roadway that would intersect wetlands. No reference to how this figure was derived was provided. On page 10-19 the document states that "The area of wetlands filled by the roadbed would be 0.11 km2 (i.e., approximately 12 km of road, assuming a road width of 9 m)," although it is not clear if this is the calculation to which the statement refers.

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Page	**Section**	**Excerpt**	**Contributor**	**Response/Comment**	**Recommended Change**	**Addressed?**	**Comments**
5.65	Report Section Identification: 5.4.8.2		State of Alaska	Comment: Similar to section 5.4.8.1, total potential worst-case impact is implied and assumed. The assumption that significant impacts occur on every crossed stream both upstream to non-fish bearing conditions, and downstream to an outlet, grossly overstates and misrepresents likely impacts. It is not clearly stated how upstream portions of streams will be impacted. In earlier portions of the Bristol Bay Assessment it is stated impacts MAY extend to 200 meters away from the road. However, later in the assessment, it implies the impact can be measured miles downstream and upstream. The mileage represented in Tables must be qualified such that is does not imply impacts to the entire mileages listed.	Recommended Change: Provide discussion about the level of impacts close to the road and account for the distance downstream where impacts are ameliorated, particularly for those streams that are crossed only once and/or do not have any fish in them near the road crossing.	No	There is no indication of the level of impact associated with the transportation corridor, only distances are provided. There is no clear indication how the upstream portions will be impacted, aside from restricted access through culvert blockages. The same buffer distances were used to estimate distance of impact in this analysis (Box 10-1).
5.74	Report Section Identification: 5.4.10		State of Alaska	Comment: Because a stream by stream assessment has not been done and actual stream crossings have not been designed or located, it is impossible to determine the actual impacts. The purported "likely" diminished production on 510 km of 30 streams is likely a significant overestimate of potential impacts.	Recommended Change: Examine width of stream versus width of flood plain and determine whether culverts would be adequate to maintain stream function and fish passage and where bridges are required to do the same. Given use of appropriate culverts, bridges, and road construction practices, estimate damages downstream, within the most likely length of impact, (200 meters?).	No	Ch 10 - The stream width vs. width of floodplain was not used to determine culvert effectiveness. Blockages were assumed to occur, unless regular maintenance was performed.

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6.42	Report Section Identification : 6.4		State of Alaska	Comment: Simply using bridges over smaller streams would essentially eliminate the potential for culvert failures. Proper culvert design and conservative over-sizing, would significantly reduce potential for culvert failure.	Recommended Change: Provide more detailed analysis on culvert failure rates for well designed or oversized culverts for the size of streams most likely to be culverted along the corridor.	No	Ch 10 - Culverts were assumed to fail unless regularly maintained. No consideration of bridges over small streams was provided in the analysis.
6.43	6.4.3	Section 6.4.3, Page 6-43, Last Paragraph, Last Two Sentences: "Thus, two of the remaining 16 streams with less than 5.5 km of upstream habitat might be bridged, leaving 14 salmonid streams with culverts. Assuming typical maintenance practices after mine operations, roughly 50% of these streams, or 7 streams, would be entirely or in part blocked. As a result, salmon spawning would fail or be reduced in the upper reaches of the streams and the streams would likely not be able to support long-term populations of resident species such as rainbow trout or Dolly Varden."	HDR	This conclusion is based the assumption that all culverts are designed similar to those case studies implemented in the past three decades, which do not adequately account for the natural geomorphic and biological processes of sensitive stream habitats. Culverts designed using modern design guidelines developed by ADOT&PF, CDFG, NMFS, USDA, FHWA, WDFW, and others can be implemented to reduce potential impact to the physical and biological resources of streams and rivers.		No	Modern standards are discounted in the statement, "Although culverts would be designed to certain specifications (Box 10-2), they are not always installed correctly or do not stand up to the rigors of a harsh environment, as indicated by the failure frequencies cited in Section 10.3.2.1." (pages 10-27 to 10-28). Box 10-2 provides information on culvert mitigation provided in the MOA between ADOT and ADF&G (a 2001 document).

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6.43	6.4.3	Thus, two of the remaining 16 streams with less than 5.5 km of upstream habitat might be bridged, leave 14 salmonid streams with culverts. Assuming typical maintenance practices after mine operations, roughly 50% of these streams, or 7 streams, would be entirely or partly blocked .	Knight Piesold	We could address this comment about typical maintenance practices once we know more about how the road is being designed and the validity of the 50% assumption.		No	No more information was provided to account for the maintenance assumption and culvert failure, although the estimate was revised from 50% to 47% in the revised version.

EPA-7609-0003748_0101

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ORIGINAL DRAFT LOCATION			ORIGINAL COMMENT			COMMENTS REGARDING ADEQUACY OF RESPONSE IN SECOND DRAFT	
Page	**Section**	**Excerpt**	**Contributor**	**Response/Comment**	**Recommended Change**	**Addressed?**	**Comments**
5/59	Report Section Identification : 5.4 Road and Culvert Failures, Stormwater Runoff		State of Alaska	Comment: The narrative implies that only roads can have negative effects on stream passage. Flood events can have substantive changes in the natural stream environment in regards to 'modification of drainage networks, acceleration of erosion processes, which, in turn, can lead to changes in streamflow regimes, sediment transport and storage, channel bank and bed configurations, substrate composition, and the stability of slopes adjacent to streams.' The assumption that roadway salts would be used for general winter maintenance is a considerable jump. BMPs for roadway maintenance in winter climates depend largely on the temperatures, existing road surface, type and rate of vehicle travel, and other considerations. In colder climatic conditions, salts are not utilized for winter maintenance. If salts/brines are used for winter maintenance they are typically used on paved roadways. Given the heavy vehicle traffic this road would carry, this writer assumes a non-paved surface for the major roadways.		No	Pg 10-30 The assumption that road salts are an issue is implied by the statement *...chemicals released during spills along the corridor, and salts or other materials used for winter road treatment.* The term 'paved' is not even used in Chapter 10. The comment has therefore not been addressed.

EPA-7609-0003748_0102

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ORIGINAL DRAFT LOCATION			ORIGINAL COMMENT			COMMENTS REGARDING ADEQUACY OF RESPONSE IN SECOND DRAFT	
Page	**Section**	**Excerpt**	**Contributor**	**Response/Comment**	**Recommended Change**	**Addressed?**	**Comments**
4.41	Box 4-4	Tennessee Valley Authority Kingston Fossil Plant, Roane County, Tennessee, 2008. After receiving nearly 20 cm of rain in less than 4 weeks, an engineered 18-m-high earthen embankment of a 34-ha storage impoundment failed, producing a 14-m-high surge wave and releasing 4.1 million m3 of coal fly ash slurry. The release covered over 121 ha with slurry containing arsenic, cobalt, iron, and thallium. Over 2.7 million m3 of coal ash and sediment were dredged from the Emory River to prevent further downstream contamination (AECOM 2009).	Knight Piesold	Perhaps the intent of this example is to demonstrate that tailings dam failures can also happen in the USA? However the failure of this earthen (fly ash) upstream construction dam that was founded on silt and clay is not comparable to Pebble. The failure was attributed to the foundation, construction rate, construction material and placement method (lack of compaction).		No	The Tennessee Valley Authority Kingston Fossil Plant example is still included in Box 9-1 "Examples of Historical Tailings Dam Failures." As the reviewer notes, this example is not comparable to the type of tailings facility that would be required for a mining project in this watershed.

EPA-7609-0003748_0103

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ORIGINAL DRAFT LOCATION			ORIGINAL COMMENT			COMMENTS REGARDING ADEQUACY OF RESPONSE IN SECOND DRAFT	
Page	**Section**	**Excerpt**	**Contributor**	**Response/Comment**	**Recommended Change**	**Addressed?**	**Comments**
4.46	4.4.2.2	Silva et al. (2008) reported on over 75 earth dams, tailings dams, natural and cut slopes, and some earth retaining structures to illustrate the relationship between the annual probability of slope failure in earth structures and factors of safety. They grouped projects into four categories based on the level of engineering applied to the design, site investigation, materials testing, analysis, construction control, operation, and monitoring of each project. • Category I: Facilities designed, built, and operated with state-of-the-practice engineering. Generally these facilities are constructed to higher standards because they have high failure consequences. • Category II: Facilities designed, built, and operated using standard engineering practice. Many ordinary facilities fall into this category. The tailings dams in our mine scenario would be	Knight Piesold	Silva paper is for earthfill slopes/dams, information is based on 40 years of case studies, engineering practices have changed. EPA seem to base their comments on a hypothetical dam that haas been designed to probably fail. They erroneously assume that this could be permitted and allowed to proceed into construction and operation. they then suggest that this would relate to 'any' dam at Pebble. The Silva paper also defines the category 1 or 2 facilities design criteria more clearly, from which Pebble would be category 1. The annual failure probability of an earthfill slope for a factor of safety of 1.5 (which is the minimum) is 1 in 1,000,000 (i.e. this is implied to be negligible by Silva et al). It is worth noting that it could be argued that the Pebble dams could be designed to a higher factor os safety and thus an even lower probability of failure - if 1 in a million is presented as being negligible how much more negligible should the designs be based on. The Alaska Dam Safety program defines these requirements for any dam developments in the State - does the EPA trump this State regulatory process?		No	(Silva et al. 2008) is still used as the part of the failure assessment in Chapter 9. The assessment assumes that the probability of mine failure is similar to that of historical mines constructed to outdated standards. As a result, the assessment overstate likely impacts.

EPA-7609-0003748_0104

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ORIGINAL DRAFT LOCATION			ORIGINAL COMMENT			COMMENTS REGARDING ADEQUACY OF RESPONSE IN SECOND DRAFT	
Page	**Section**	**Excerpt**	**Contributor**	**Response/Comment**	**Recommended Change**	**Addressed?**	**Comments**
4.47	Report Section Identification : Chapter 4.4.2.2		State of Alaska	Comment: The likelihood has been estimated, substantially, from the historic records of dam failures that have been recorded in the years 1960 to 2010. Many of the dams that are included in this failure record were constructed in periods prior to current engineering and oversight. The ability to perform effective analyses must precede the practice of performing such analyses and if we look to when a) the capability and b) the practice of analyses of very important aspects of dam design were developed, we can see that many dams that have failed were not designed with adequate design methods. The flowing times are when the technology and practice became common for critical elements of tailings dam design in North America: Slope stability analyses 1960's Seepage and drainage analyses 1970's Seismicity, foundation soils and tailings liquefaction, and dynamic analyses 1970's and 80's Modeling tools for deformation (FLAC, PLAXIS) Post 1980's Design for Closure and Closure management (not just abandonment) has only been a substantive requirement since the 1990's. In areas other than North America, these technologies and the regulatory oversight and corporate governance that today control the security of dam construction were not applied till substantially later. Thus many of the dams, indeed the vast majority, included in the failure statistics did not include the design, specifications and construction and operation supervision that would be required today for a major tailings dam constructed in Bristol Bay. The site investigation, construction material characterization, design effort and construction supervision that is applied to smaller, lower hazard dams are vastly less than are applied to very large high hazard dams. The engineering man-hours that would be		No	The current analysis (Section 9) is essentially based on the same level of historical analysis as was presented in first review draft; the reviewer's point on the beneficial effects of "current technology, regulatory control and corporate governance" on potential failure rates is not accounted for.

EPA-7609-0003748_0105

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Page	**Section**	**Excerpt**	**Contributor**	**Response/Comment**	**Recommended Change**	**Addressed?**	**Comments**
6.33	Report Section Identification: 6.2.1.1		State of Alaska	Comment: The last paragraph of this section, just below Table 6-8 is likely incorrect. Not all invertebrates will die at the probable effect concentration (PEC), and only predicted concentrations of copper notably exceed the PECs. Invertebrates would colonize the fine-grained sediment resulting from a pipeline spill, just not those sensitive to the metals contained within the pipeline slurry.	Recommended Change: More accurately represent what is likely to occur.	No	Pg 11-16 while the original statement has been removed, the following is an example of the analysis that remains: *A concentrate spill into a stream is likely to kill invertebrates and early life stages of fish immediately. If it is not remediated (and remediation of streams may not be possible), it would certainly cause long-term local loss of fish and invertebrates.* It appears that the comment has not been addressed.

EPA-7609-0003748_0106

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ORIGINAL DRAFT LOCATION			ORIGINAL COMMENT			COMMENTS REGARDING ADEQUACY OF RESPONSE IN SECOND DRAFT	
Page	**Section**	**Excerpt**	**Contributor**	**Response/Comment**	**Recommended Change**	**Addressed?**	**Comments**
6.34	Report Section Identification : 6.2.1.3		State of Alaska	Comment: Why are Liters used in this section? 366,000 Liters sounds like a very large amount number, but is about 100,000 gallons or 366 cubic meters which is a relatively small volume. Also it is unclear whether this is liters of water entrained in the slurry or total volume of slurry, in which case, the water volume would be significantly less. The statement that "None of the river or streams ...could provide enough dilution to avoid the acute criterion" is misleading. Acute criteria are generally based on 48 hour or 96 hr LC50 or similar endpoints. As soon as the two-minute spill ended, the water within the slurry would begin to be diluted by clean stream water. Similarly, but more slowly, the pore water within the slurry would be infiltrated and diluted by clean stream water. Over some relatively short period of time the water concentrations outside of the slurry would likely rapidly decrease below acute criteria. This could be minutes to hours. Thus, it is unlikely flowing water would have metals concentrations raised up to the criteria for more than a few minutes or hours. It is also likely that within days, the pore water within the spilled slurry would be notably diluted. Longer term high concentrations could be possible in a small pond or wetland where there is no significant flow. A very small 5-liter per second stream provides 18,000 L per hour and 432,000 L per day. So in one day 5 L/s stream could provide clean water volume of 100% of the total spill volume.	Recommended Change: Provide a more accurate description/understanding of the dynamics of a slurry spill entering moving water.	No	The current slurry spill scenarios for Chinkelyes and Knutson Creeks does not address the time of exposure, and uses the single point estimate of concentration in comparison with the AWQC. No discussion of the exposure durations are considered in this evaluation.

EPA-7609-0003748_0107

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Page	**Section**	**Excerpt**	**Contributor**	**Response/Comment**	**Recommended Change**	**Addressed?**	**Comments**
6.38	6.3.3	Sentence 2	ENVIRON	The authors state that Tertiary waste rock leachate would exceed the national ambient water quality criteria for copper, but do not acknowledge that the average copper concentrations would be below Alaska's hardness-based standards for both the criterion maximum concentration and the criterion continuous concentration. It seems that the more site-specific criteria comparison is also important to present.	Comment reference: West et al. 2009	No	The current draft presents the same information concerning the national AWQA for copper. The comment was not addressed.
6.38	6.3.3	Sentence 4	ENVIRON	The statement that acute or chronic toxicity to invertebrates through exposure to Tertiary waste rock leachate could occur at up to two times dilution is not supported. If this statement is supported in a previous section, that sections should be noted and Table 5-14 should be referenced.	Comment reference: West et al. 2009	No	This comment is not reflected in the current review draft. The comment stands. The impacts are likely overstated.
4.26	Report Section Identification : Section 4.3.7		State of Alaska	Comment: The river diversion plan assumes that the blocked creeks/rivers will eventually find a way to flow around the mine site and TSF, however, it might not be the case in many areas, particularly during the high flow season (either caused by heavy rainfall and snow melt). During the high flow season, surface water runoff might cause flooding, top the TSF, and/or move the potential contaminants into downstream water bodies if PAG waste rock is encountered.	Recommended Change: Provide more detailed info on the river diversion plan, including the topographic information for the areas where the streams will be blocked by the mine pit or waste rock piles. Provide high seasonal flow information in the affected area and its impact on the mine site and safety of the TSF dam.	No	Section 6.1.2.5 Mention of stream diversion has been deleted in this version, although a statement concerning a figure notes that for clarity, diversions of stormwater around mine component s are not shown on the schematic.

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Page	**Section**	**Excerpt**	**Contributor**	**Response/Comment**	**Recommended Change**	**Addressed?**	**Comments**
4.30	Report Section Identification : 4.3.7 Water Management		State of Alaska	Comment: The geographical basis for the water balance provided in Table 4-5 excludes the area outside the immediate vicinity of the mine site. Typically, project-area water balances take into account flows for individual surface water bodies, water-bearing units/aquifers, and areal variability of precipitation and runoff components. In short, this water balance appears to lack acknowledgement of the key natural systems at and near the mine site. Also, water balances consider seasonality aspects (for example, monthly) and the effect of wetter- and drier-than-average years.	Recommended Change: The water balance should be fully reconsidered taking into account the comments above, and represented in a concise way with supporting figures, charts and tables.	No	Although revised table (Table 6.8) addressed water balance in more detail, this comment was not addressed.
4.31	Section 4.3.8, paragraph 1, sentences 2, 3, and 4		ENVIRON	Either change "would" to "could" or explain that this is an assumption. Also discuss the mitigation assumed to be in place. Further discussion of other possible mitigation options and discussion of the effect of location, surface and groundwater quantities, and topography on the potential effects is warranted in this paragraph.		No	Section 6.3 the first paragraph remains essentially the same, and mitigation measures not clearly discussed. The comment has not been addressed.
4.31	Section 4.3.8.1, page 4-31, first paragraph, sentence 2		ENVIRON	The sentence states: "We assume that at closure the dewatering pumps in the pit would be turned off. Groundwater would continue to flow toward the pit in response to the local gradient." We appreciate the fact that this was stated as an assumption, however the assumption may not be valid. At mine closure, long-term requirements for monitoring and mitigation are required. The pumps will be turned off only if approved in the mitigation and restoration plan.		No	Section 6.3.1 the statement regarding turning off the pumps remains. The comment has not been addressed.

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Page	**Section**	**Excerpt**	**Contributor**	**Response/Comment**	**Recommended Change**	**Addressed?**	**Comments**
4.31	Section 4.3.8.1, page 4-31, first paragraph, sentence 4		ENVIRON	The methods used to develop the estimate are not presented so the source of the information is not known. Most of this document assumes shallow groundwater and substantial groundwater/surface water interaction. Given the precipitation in the area and the assumed groundwater situation, the estimate of 100 to 300 years to fill is highly questionable. The assumptions in the document need to be consistent. You cannot assume shallow groundwater for impacts of operations and deep groundwater for impacts on filling of the pit.		No	Some explanation is provided regarding the time to fill (now it is estimated to 20 to 300 years, depending on the mine scenario). However, no discussion regarding depth to the groundwater has been provided.
4.33	Section 4.3.8.5,page 4-33, paragraph 3		ENVIRON	This paragraphs seems to imply that environmental protection requirements imposed when a mine was opened may not be required when it was re-opened. While the requirements may change, they will not change without good evidence that the changes will not result in significant environmental impacts. This needs to be acknowledged.	See http://dnr.alaska.gov/mlw/water/dams/	No	Not addressed (See Chapter 6). The analysis assumes standards and mitigation requirements for a project that do not meet current requirements. Therefore, the analysis overstates like impacts.
4.52	Box 4-7	We used the U.S. Army Corps of Engineers (USACE) Hydrologic Engineering Center's Hydrologic Modeling System (HEC-HMS) to generate a reasonable runoff hydrograph based on a 24-hour probable maximum precipitation (PMP) event of 356 mm (14 inches) (Miller 1963).	Knight Piesold	The use of the phrase "a reasonable runoff hydrograph" implies normalcy. The flood resulting from a PMP is anything but "normal." It is so extreme and unlikely that no probability can be assigned to it.		No	Not addressed (see Chapter 6). The runoff calculation are not based on a quality assessment; the effects of that failure on the overall assessment is not known.

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Page	**Section**	**Excerpt**	**Contributor**	**Response/Comment**	**Recommended Change**	**Addressed?**	**Comments**
4.53	Box 4-8	If sufficient freeboard is maintained, it would be possible to capture and retain the expected volume of the PMF in the TSF. However, to examine potential downstream effects in the event of a tailings dam failure, we assume that sufficient freeboard would not exist and overtopping would occur. This may be less likely when the TSF would be actively monitored and maintained, but may be more representative of post-closure conditions.	Knight Piesold	At post-closure the facility would be have a spillway designed to safely convey the peak flow of the PMF, so it is not conceivable that this event would occur as assumed. On-going monitoring and maintenance is inevitable and the EPA assumption of site abandonment is not realistic because it is illegal (or at least non-permitable).		No	Not addressed (see Chapter 6). The assessment assumes that the project would not be designed to capture spilled materials. This may not be a good assumption. The impacts described can be fully or at least partially addressed through proper project design.
4.6	Section 4.4.2.4, p. 4-60, 2nd paragraph		ENVIRON	The document suffers from the lack of sediment transport analysis. Much of the analysis of effects assumes that the deposited sediment would remain in the channel for extremely long periods of time. The material is fine grained and would be expected to be mobilized and transport out rather quickly, although the analyses of impacts assume something quite different. Recommend including an analysis of sediment transport and expected longevity of impacts.		No	Similar description is provided in the revised document (page 9-23, last paragraph). A proper sediment transport analysis has not been conducted. The effects of this on the overall conclusions is unknown, but the analysis likely overstates the potential impacts.

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Page	**Section**	**Excerpt**	**Contributor**	**Response/Comment**	**Recommended Change**	**Addressed?**	**Comments**
5.27	section 5.2.2.1, p 5-27, 1st sentence under post-closure		ENVIRON	This is an assumption and should be stated as such. The reclamation plan may call for a different strategy which could affect the effects. Alternative strategies should be discussed.		No	New Section 7.3.14 re-states the same sentence. Alternative designs and mitigation approaches are not adequately addressed in the document.
Multi le	Report Section Identification : 2.0 and 4.3.7		State of Alaska	Comment: High seasonal fluctuations exist in the mine area as shown in Figure 2-7, page 2-23. However, the seasonal effects were not adequately considered in the water balance estimation. Frozen conditions would have a major impact on flows in creeks and runoff. Peak seasonal precipitation and snow melt would also have a major impact on the water balance. Water balance estimated with averaged precipitation (as in Box 4-2, page 4-28) will not represent the seasonal field conditions.	Recommended Change: Provide temporal and seasonal fluctuation of rainfall, stream flow, and groundwater level. Evaluate the mining impact on water balance under long term average condition and high seasonal flow condition.	No	The same figure is incorporated in the revised text (Figure 7.5) and the suggested analysis has not been incorporated. Since the analysis continues to rely upon average streamflow ignoring consideration of seasonal fluctuations, accurate predictions of streamflow impairment are questionable.
4.27	Report Section Identification : 4		State of Alaska	Comment: This page states that the mining operation would always consume some water and there would always be less water available in streams during active mining than there was before the mine was present. This contradicts Section 5.3.1 which states that "During the start-up phase, all water from the site would be collected and used in operations. However, during the minimum and maximum mine operations, 5 million to 48 million cubic meters of water available on the site per annum would exceed operational needs, and treated water would be discharged. (Section 4.3.7)". This contradiction is important to rectify since it has implications to the health of the streams and fisheries below the mine.	Recommended Change: Evaluate this item in detail and provide narrative on it. Make any changes to the water balance.	No	This section was re-written, but it appears that the comment was not addressed.

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ORIGINAL DRAFT LOCATION			ORIGINAL COMMENT			COMMENTS REGARDING ADEQUACY OF RESPONSE IN SECOND DRAFT	
Page	**Section**	**Excerpt**	**Contributor**	**Response/Comment**	**Recommended Change**	**Addressed?**	**Comments**
6.11	Report Section Identification: 6.1.3		State of Alaska	Comment: This section provides thresholds for suspended sediment, and thus, is closer to a risk assessment than many other sections of the Bristol Bay Watershed Assessment, comparing site conditions to threshold effect conditions. However, while this Assessment does some modeling of sediment transport, there are no actual modeled suspended sediment concentrations predicted. So, the Assessment lists the threshold values, and then qualitatively estimates that site-specific suspended sediment concentrations would exceed the thresholds. The lack of site-specific values renders the any derived conclusion to be a qualitative comparison that is subject to uncertainty and opinion.	Recommended Change: Calculate estimated suspended sediment loads over time. Provide an analysis of how long and/or how often site-specific suspended sediment loads would be greater than the threshold.	No	Section 9.5.1 The suggest analysis has not been performed, and the document continues to rely upon qualitative estimates of the length of time, ie. reasonable to assume that decades (Section 9.5.1.3). Estimates of impacts made by the analysis therefore lack accuracy and may be overstated.
All	Report Section Identification: Executive Summary and Throughout		State of Alaska	Comment: While there is an economic assessment of the current conditions in the Bristol Bay area (Bristol Bay Watershed Assessment Vol. 3), there is no economic analysis related to the potential fish impacts of the mine, nor of the potential recreational opportunities that develop due to the road,	Recommended Change: Do an economic cost-benefit analysis. and other economic issues. While such an evaluation may not be possible with the level of analysis provided by the EPA in the Bristol Bay Watershed Assessment, it would seem possible that a minimal mine-related economic impact on the fisheries could be off-set by mine-related economic benefit of greater proportion.	No	Page 1.2, paragraph 4 states "This assessment is not an environmental impact assessment, an economic or social cost-benefit analysis, or an assessment of any one specific mine proposal." And page ES-9 states "The economic effects of mining are not assessed." Comment was acknowledged but not addressed. Therefore the original comment still stands.

EPA-7609-0003748_0113

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ORIGINAL DRAFT LOCATION			ORIGINAL COMMENT			COMMENTS REGARDING ADEQUACY OF RESPONSE IN SECOND DRAFT	
Page	**Section**	**Excerpt**	**Contributor**	**Response/Comment**	**Recommended Change**	**Addressed?**	**Comments**
all in Cha ter 4.	Report Section Identification : 4 entire		State of Alaska	Comment: Much of what the Pebble Limited Partnership can do for environmental protection is based on the economics for the mine. This is not discussed in the Bristol Bay Watershed Assessment. It would be helpful to know the long term economics of the mine, which are described in detail in the Northern Dynasty Minerals, Ltd. Report of 2011, and whether they are based on conservative metal prices. The following list shows prices used in the economics calculated for the Northern Dynasty Minerals, Ltd. Report of 2011 compared to current prices. Copper $2.50/lb Current $3.33/lb Gold $1050/ounce Current $1610/ounce Molybdenum $13.50/lb Current $14.90/lb Silver $15.00/ounce Current $28.00/ounce Rhenium $3000/lb Current $2900/lb Palladium $490/ounce Current $618/ounce	Comment Reference: Northern Dynasty Minerals "Preliminary Assessment of the Pebble Project Southwest Alaska" issued on February 17, 2011, by Wardrop, a Tetra Tech Company, pages 12	No	Page 1.2, paragraph 4 states "This assessment is not an environmental impact assessment, an economic or social cost-benefit analysis, or an assessment of any one specific mine proposal." And page ES-9 states "The economic effects of mining are not assessed." Comment was acknowledged but not addressed. Therefore the original comment still stands.
ES.10	Report Section Identification : Volume 1 Geological Resources and Mine Scenario		State of Alaska	Comment: While the assessment lays out a potential mine it does not make an attempt to assess the economic impact or number of workers employed by such a mine. While the assessment notes public sources for data used to determine the so called plausible mine scenario presented. The same attempt is not made concerning economic impacts or workforce, despite there being the publically available information posted by the Pebble Limited Partnership.		No	Page 1.2, paragraph 4 states "This assessment is not an environmental impact assessment, an economic or social cost-benefit analysis, or an assessment of any one specific mine proposal." And page ES-9 states "The economic effects of mining are not assessed." Comment was acknowledged but not addressed. Therefore the original comment still stands.
AD.100	Appendix D	paragraph 2	ENVIRON	Link provided for the Census unemployment rate data is inactive. Please replace with current one.		No	Page 85, Link was updated to a current link, but the existing link does not provide unemployment rates. Therefore the original comment still stands.

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Page	**Section**	**Excerpt**	**Contributor**	**Response/Comment**	**Recommended Change**	**Addressed?**	**Comments**
2.17	Report Section Identification : 2.2.4		State of Alaska	Comment: If the total estimated annual salmon ecosystem direct expenditures is $479.6 million that should be put in context with the value of the mineral resources in the same area.		No	Section 5.2.3, Pages 5-23 and 5-24. This section is almost identical to previous Section 2.2.4. adding no additional information as recommended. Page 1.2 states "This assessment is not an environmental impact assessment, an economic or social cost-benefit analysis, or an assessment of any one specific mine proposal." And page ES-9 states "The economic effects of mining are not assessed." Comment was acknowledged but not addressed.
4.28	Report Section Identification : Chapter 4.3.7		State of Alaska	Comment: Box 4-2. Water Balance Calculations: The fundamental definition of a water balance is not adhered to in the discussion, thus making the results of the analysis worthless. Although the authors purportedly seem to be able to design AND comment on the negative effects of a yet to be designed and permitted facility, the water balance cannot be finalized until an understanding of water use within the facility itself is complete. The hypothetical inflows and outflows of a speculative design do not in itself, constitute a water balance.		No	There is more comprehensive discussion regarding calculation of water balance (whole new section 6.2.2). However, this new discussion does not provide sufficient depth of details necessary to understand how is the water balance affected with assumed water use in the mine, i.e. simple sensitivity analysis. Therefore, the analysis is still lacking in quality.

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Page	**Section**	**Excerpt**	**Contributor**	**Response/Comment**	**Recommended Change**	**Addressed?**	**Comments**
4.46	Report Section Identification : Chapter 4.4.2.2		State of Alaska	Comment: EPA cites ADNR Guidelines for Cooperation with the Alaska Dam Safety Program (June, 2005) (ADNR Dam Safety Guidelines) and references therein to U.S. Army Corps of Engineers, U.S. Bureau of Reclamation, and Federal Energy Regulatory Commission guidelines for designing water retaining dams to safety factors of 1.5 (for slope stability). Box 4-6, Selecting Earthquake Characteristics for Design Criteria, includes general descriptions of earthquake design criteria, and criticizes the ADNR dam safety guidelines as 'inconsistent with the expected conditions for a large porphyry copper mine developed in the Bristol Bay..." Section 13.2.2, Tailings Storage Facilities, of the ADNR Dam Safety Guidelines specifically states, "Complete guidance on tailings dam design and closure is beyond the scope of this document...tailings dams represents certain challenges that require professionals with significant relevant experience." EPA leans heavily on the 1.5 safety factor for estimating failure probabilities and references (Silva, et al. , 2008). However, unlike the Assessment, Silva presents a balanced discussion on risk for a mine project, and other engineering features such as dams.		No	The language from Box 4.6 in the original version has been retained in Box 9.2 pg. 9-9, including the statement regarding inconsistencies with ADNR dam safety standards and expected conditions. The comment does not appear to have been addressed.

EPA-7609-0003748_0116

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Page	**Section**	**Excerpt**	**Contributor**	**Response/Comment**	**Recommended Change**	**Addressed?**	**Comments**
ES.15	Executive Summary	The annual probability of failure for each tailings dam would be in the range of one-in-ten-thousand to one-in-a million. The probability of one of several tailings dams failing increases with the number of dams.	Knight Piesold			No	Pg ES-21 The annual probability for dam failures has been decreased to a range of 0.0004 - 0.0000004 based upon the fact that probabilities of 0.0001 - 0.000001 were generated based upon slope failures which account for only 25% of dam failures, making the total probability 4x higher. The commentator's lower figure of 0.00001 was not discussed nor adopted. No discussion of probability as related to multiple dams has been included. Therefore, the comment has not been addressed.
2.21	Section 2.3.2, page 2-21, paragraph 5		ENVIRON	Nushagak River is defined with "high base flow" - that is incorrect, according to Figure 2-7B.		No	Pg 3-14, first paragraph; the original language concerning high base flows remains unchanged, as does new Figure 3-10 pg. 3-17. Furthermore, no additional language has been added in this paragraph to discuss the apparent discrepancy noted by the commentator. The comment has therefore not been addressed.
8.11	8.5 Summary of Uncertainties and Limitations in the Assessment	The proportion of the tailings that would spill in the event of a dam failure could be larger than the largest value modeled (20%).	Knight Piesold	Interesting statement. Based on the size of the ultimate impoundment, the estimated volume of ponded water from preliminary water balances and the consolidation characteristics of the tailings (deeper and denser tailings will not liquefy and flow out of a hypothetical breach), it is actually more likely that the proportion of tailings that 'would spill' should be assumed to be significantly less than 20% rather than more.		No	Section 14.5 second bullet - the same statement remains without explanation. The comment has therefore not been addressed.

EPA-7609-0003748_0117

Attachment B – Technical Comments

ORIGINAL DRAFT LOCATION			ORIGINAL COMMENT			COMMENTS REGARDING ADEQUACY OF RESPONSE IN SECOND DRAFT	
Page	**Section**	**Excerpt**	**Contributor**	**Response/Comment**	**Recommended Change**	**Addressed?**	**Comments**
4.41	Page 1 and Preface	Stava, Italy, 1985. Two tailings impoundments were built, one upslope from the other, in the mountains of northern Italy. The upslope dam had a height of 29 m; the downslope dam had a height of 26 m. A stability failure of the upper dam released tailings, which then caused the lower dam to fail. The 190,000 m3 of tailings, traveling at up to 60 km/hour, reached the village of Tesero 4 km downslope from the point of release, in 5 or 6 minutes. The failure killed 269 people (ICOLD 2001).	Knight Piesold	Decant failure causing a raise in the phreatic surface resulting in rotational slips on the downstream slope. The dams were upstream and centerline construction using hydraulically placed cyclone sand material. This is old and poor technology that is not relevant to Pebble		No	Box 9-1 The same information has been retained as in the previous table without additional discussion or qualification. The comment has therefore not been addressed. Comparisons with mines that were developed under outdated standards is inappropriate and tends to overestimate the magnitude of likely effect.

EPA-7609-0003748_0118

Attachment B – Technical Comments

ORIGINAL DRAFT LOCATION			ORIGINAL COMMENT			COMMENTS REGARDING ADEQUACY OF RESPONSE IN SECOND DRAFT	
Page	**Section**	**Excerpt**	**Contributor**	**Response/Comment**	**Recommended Change**	**Addressed?**	**Comments**
4.44	Report Section Identification : Chapter 4.4.2.1		State of Alaska	Comment: In Table 4-7, EPA lists examples of earthquakes in Alaska ranging from a magnitude 3.0, located 122 km from the project, to the Great Alaska Earthquake of 1964, a magnitude 9.2 located 469 km from the project. The nearest earthquake listed is a magnitude 4.3, located 30km from the project. A note on the table states, "...earthquakes in the range of magnitudes 2.5 to 3.6 occur regularly in the Lake Clark area...)". The earthquakes listed by EPA in relation to the Pebble deposit are technically insignificant. National guidelines for incident reporting for dams do not require reporting for earthquakes less than 5.0 within 24 km of the project site, or for earthquakes greater than 8.5 more than 102 km from the site.	Comment Reference: Section 9 of "Guidelines for Reporting the Performance of Dams", National Performance of Dams Program, Stanford University, 1994.	No	Table 3.5 The table retains the same earthquakes as the previous one without additional discussion. The comment has not been addressed.

EPA-7609-0003748_0119

Attachment B – Technical Comments

ORIGINAL DRAFT LOCATION			ORIGINAL COMMENT			COMMENTS REGARDING ADEQUACY OF RESPONSE IN SECOND DRAFT	
Page	**Section**	**Excerpt**	**Contributor**	**Response/Comment**	**Recommended Change**	**Addressed?**	**Comments**
4.47	Report Section Identification : 4.4.2.2 Probability of Tailings Dams Failures		State of Alaska	Comment: Dam failure probabilities based on existing and anecdotal information shows a wide range (several orders of magnitude) difference in probability of failure.	Recommended Change: Considering the potential risks involved, the dam failure study should include a site specific dam failure analysis. A stochastic, risk based modeling approach is needed to address risk and uncertainty and incorporating sensitivity analyses of seismicity, soil strength and hydraulic conductivity properties, inflow hydrology, dam breach sizes, hydraulic and sediment transport downstream modeling. The analysis will refine probabilities and estimates of dam failure scenarios and reduce the uncertainty in dam failure orders of magnitude difference in estimated failure probabilities.	No	Ch 9 - Data has been added but the analysis remains the same, relying upon data from other mines to make inferences about probabilities of tailings dam failures. There is no discussion about modeling as an alternative. Therefore, this comment has not been addressed. Comparison with mines constructed to outdated standards is inappropriate and tends to overestimate likely project impacts.

EPA-7609-0003748_0120

Attachment B – Technical Comments

ORIGINAL DRAFT LOCATION			ORIGINAL COMMENT			COMMENTS REGARDING ADEQUACY OF RESPONSE IN SECOND DRAFT	
Page	**Section**	**Excerpt**	**Contributor**	**Response/Comment**	**Recommended Change**	**Addressed?**	**Comments**
2.25	Report Section Identification : 2.3.5 Ecosystem Integrity		State of Alaska	Comment: The document states " the primary human manipulation of the Bristol Bay ecosystem is the marine harvest of approximately 70 % of salmon returning to spawn" This level of harvest of a salmon resource suggests there is substantial opportunity to mitigate minor or temporary impacts from other human activities. The document goes into lengthy details of a perceived impact from a hypothetical mine using numerous assumptions but ignores the current impact to the salmon resource from the excessive by-catch by the marine commercial fishing industry. The document fails to adequately address the already significant impact to the salmon resource by human activities and that the marine harvest could be manipulated to increase uses for subsistence users.	Recommended Change: The document could address the substantial opportunity to manage and mitigate minor or temporary losses in salmon resources by actively managing the marine harvest to increase the availability of the resources to subsistence users as is already being done to account for excessive by-catch and other impacts.	No	pg 3-36 first full paragraph - the language in this paragraph remains the same with no acknowledgement of the comment. Comment has not been addressed.

EPA-7609-0003748_0121

Attachment B – Technical Comments

ORIGINAL DRAFT LOCATION			ORIGINAL COMMENT			COMMENTS REGARDING ADEQUACY OF RESPONSE IN SECOND DRAFT	
Page	**Section**	**Excerpt**	**Contributor**	**Response/Comment**	**Recommended Change**	**Addressed?**	**Comments**
4.47	Report Section Identification: Chapter 4.4.2.2		State of Alaska	Comment: EPA uses curves from Figure 1 of Silva et al, 2008 to convert the factor of safety associated with the mine scenario tailings dam to an annual probability of failure. The scope of Silva's paper is broad and is intended for a wide range of potential geotechnical applications. The four categories of "Level of engineering" included in the Assessment are abbreviations of the more detailed Table 1 included in the referenced paper. A review of Table 1 indicates that the Class II (Above Average) category is reserved for "above average" geotechnical works in a general sense. For example, Class II structures do not require an investigation of site geologic history, design peer review, full time supervision by a qualified engineer during construction or implementation of a performance program during operation, all of which would be required of any new tailings dam constructed in Alaska. The EPA assumes that the mine scenario tailings dam will be between a Class II and Class I structure and chooses to use the annual probability of failure associated with Class II structures (10-4 with a FOS of 1.5) for comparison with high historical tailings dam failure rates. Based on Silva's definition, a new large or very large tailings dam constructed in Alaska would almost certainly fall into category 1 (Best). The corresponding annual probability of failure of a Class I structure with a FOS of 1.5 is 10-6.		No	Chapter 9 continues to assume the standard of construction would be between "best" and "above average". The analysis does not adequately address the design standards and mitigation that would be required. Therefore, impacts are overstated.

EPA-7609-0003748_0122

Attachment B – Technical Comments

ORIGINAL DRAFT LOCATION			ORIGINAL COMMENT			COMMENTS REGARDING ADEQUACY OF RESPONSE IN SECOND DRAFT	
Page	**Section**	**Excerpt**	**Contributor**	**Response/Comment**	**Recommended Change**	**Addressed?**	**Comments**
ES.18	Executive Summary	The range of estimated probabilities of dam failure is wide, reflecting the great uncertainty concerning such failures. The most straightforward method of estimating the annual probability of failure of a tailings dam is to use the historical failure rate of similar dams. Three reviews of tailings dam failures produced an average rate of approximately 1 failure per 2,000 dam years, or 5 x 10^4 failures per dam year. The argument against this approach is that it does not fully reflect current engineering practice. Some studies suggest that improved design, construction, and monitoring practices can reduce the failure rate by an order of magnitude or more, resulting in an estimated failure probability within our assumed range. The State of Alaska's guidelines suggest that an applicant follow accepted industry design practices such as those provided by the U.S. Army Corps of Engineers (USACE), Federal Energy Regulatory Commission	Knight Piesold	If this is the case, why base the conclusions on the middle of the range of estimated probabilities, rather than 1 in 1,000,000 that is stated as applicable to "those designed, built, and operated with state-of-the-practice engineering." It is clear that the statistics for tailings dam failure probability are flawed, thus they would need to be ignored. Thus, even if it were accepted that this approach is reasonable, then a logical conclusion would be to assign the 1 in a million probability (i.e. the lowest probability that Silva et al could ascribe - i.e. negligible risk).		No	Not addressed.

EPA-7609-0003748_0123

Attachment B – Technical Comments

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Page	**Section**	**Excerpt**	**Contributor**	**Response/Comment**	**Recommended Change**	**Addressed?**	**Comments**
1.2	Section 1, page 1-2, paragraph 3, 5th sentence		ENVIRON	The report states that a comparative analysis of a watershed that currently supports both surface mine operations and salmon fisheries was conducted using the Fraser River in British Columbia. However, the O'Neal and Woody report concludes that: "Given their distinct physical and biological nature, as well as vastly higher levels of urbanization and industrialization in the Fraser River basin relative to the Bristol Bay basin, recent comparisons between the two watershed are suspect." There are several additional reasons why a comparison of the two watersheds and impacts on fisheries are not useful. The Fraser River basin is impacted by large populations centers (Vancouver and Victoria); and the basin is much larger than Bristol Bay (238,000 km2 and 92,000 km2, respectively). The Fraser River basin is impacted by a high degree of industrialization, including forestry, agriculture, two large hydroelectric projects, in addition to mining. The basin's water quality is extremely impacted with over 200 contaminants documented in the basin. Clearly the cumulative impacts of development in the Fraser River basin far exceed the types and number of impacts conceivably projected for the Bristol Bay basin.	Comment reference: Feddema, J. J. 2005. A revised Thornthwaite-type global climate classification. Physical Geography 26:442-466	No	Comment still stands. Comparison with the Fraser River is inappropriate for several reasons.

EPA-7609-0003748_0124

Attachment B – Technical Comments

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Page	**Section**	**Excerpt**	**Contributor**	**Response/Comment**	**Recommended Change**	**Addressed?**	**Comments**
3.2	Report Section Identification : 3.3		State of Alaska	Comment: The endpoints 2, 3, and 4 are essentially glossed over, while endpoint 1 is not well related or scaled to represent the likely site-specific impacts of the Pebble mine. The conclusions of this document is used to directly assess impacts of the mine without an in depth consideration and quantification of site-specific actions and impacts.		No	Endpoints have been collapsed into three (Section 5.1), but Endpoint 1 (fish) uses habitat as a surrogate to address a lack of data on fish abundance, productivity, diversity'. This link is tenuous, and the underlying analysis does not make clear the relationship.
14	Appendix I	Data presented indicate that failures peaked to about 5 per year in the 1960's through the 1980's and has dropped to about 2 per year over the last 20 years, with the frequency of failure occurrences shifting to developing countries.	Knight Piesold	Data set needs to be filtered before making any comparisons to Pebble - see KP Whitepaper 1.		No	Comparisons with old dams and dams outside of the U.S. remain in the document. The analysis is therefore flawed by an insistence with comparing the proposed project to other projects that are not comparable.
4.41	Box 4-4	Aznalcóllar Tailings Dam, Los Frailes Mine, Seville, Spain, 1998. A foundation failure resulted in a 45-m-long breach in the 27-m-high, 600-m-long tailings dam, releasing up to 6.8 million m3 of acidic tailings that traveled 40 km and covered 2.6 million ha of farmland (ICOLD 2001).	Knight Piesold	Foundation failure of the underlying marl (mudstone). Site investigations were inadequate. This is not relevant for Pebble as these geological materials are not present AND because extensive geotechnical investigations have and will be conducted to prove the suitability of the foundations.		No	Box 9-1 The same information has been retained as in the previous table without additional discussion or qualification. The comment has therefore not been addressed.

EPA-7609-0003748_0125

Attachment B – Technical Comments

ORIGINAL DRAFT LOCATION			ORIGINAL COMMENT			COMMENTS REGARDING ADEQUACY OF RESPONSE IN SECOND DRAFT	
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2.25	Section 2.3.3		ENVIRON	The Reader expects more from this section, especially following the thesis statement (pg. 1) "....operating at multiple scales and across multiple species - greatly increases the region's ecological productivity and stability." The entire section (3 paragraphs) centers only on genetic diversity of salmon. There is no discussion of species diversity, sensitive species, listed species, genetically fragile, or diverse species (other than salmon), or any mention of the complex vegetation and if this complexity lends itself to greater resistance to impacts (as the literature indicates) or is inherently a value to be protected because of its uniqueness, or its inclusion of sensitive and unique species. This section is lacking in information.		No	This section is restated almost verbatim in Section 5.2.4. The only major difference is that the concept of a "Portfolio Effect" is briefly alluded to by adding the following text: "This stock complex structure can be likened to a financial portfolio in which assets are divided among diverse investments to increase financial stability. Essentially, it creates a biological portfolio effect (Schindler et al. 2010), stabilizing salmon productivity across the watershed..." Thus, the comment is not evenly partially addressed.
AD.20	Appendix D	paragraph 1	ENVIRON	A reference to the archeological surveys conducted by BIA archeologists in connection with Native allotment assessments should be included.		No	On page 21, Appendix D, the original statement has been removed. If it was the commenter's intent to have the BIA study referenced, this comment has not been addressed.

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Attachment C – The resumes of the ENVIRON professionals who prepared comments

ENVIRON

Wayne Coppel, Manager

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Mr. Wayne Coppel is a Senior Manager based in Anchorage, Alaska. He has 20 years experience in the areas of environmental compliance, permitting, natural resource management and contaminated site management.

EDUCATION

1976 MS, Environmental Science and Engineering, Virginia Tech, Blacksburg, VA

1973 BS, Physical Science, University of Maryland, College Park, MD

EXPERIENCE

Air Quality Experience

- Served as a seconded air quality and permitting consultant to Chevron MCA, Anchorage, Alaska. Assisted with air compliance including calculating Title V assessable emissions, AOGCC Form 10-422 parameters and Title V annual compliance certification. In addition, assisted with transfer of air permits and other environmental permits from Chevron to Hilcorp Alaska.
- Served as Project Manager of the Subpart W Source Profiling and Gap Assessment project for Chevron MCA Cook Inlet assets. Conducted field inventory of all GHG emission sources from 3 onshore fields, 10 offshore oil/ gas production platforms and 2 underground gas storage facilities in accordance with EPA's Mandatory Reporting Rule (MRR). Assessed Chevron operational data management systems to map data required for MMR and commenced populating calculation tools (GOADS methodology) to estimate GHG emissions.
- Served as Project Manager to evaluate the 20-year regulatory compliance record of Flint Hills North Pole Refinery's air, wastewater, contaminated site and oil spill prevention activities.

Pipeline Planning and Pre-Permitting Experience

- Served as Deputy FERC Lead on the Alaska Pipeline Project (ExxonMobil, Anchorage Alaska) and assisted with the management of Resource Reports including evaluation of potential impacts associated with the proposed 734-mile natural gas pipeline, gas treatment plant and supporting infrastructure.
- Served as Project Manager to prepare scoping documents for the wetland delineation of three alignment alternatives and incorporating access roads, pads, construction areas and other affected areas into the 488-mile Beluga to Fairbanks natural gas pipeline project for ANGDA. Identified delineation data gaps, project-applicable state/ regional/ local regulatory and permit application requirements to meet compliance obligations.

Risk Assessment Experience

- Served as Project Manager of the Consequence Analysis Report for the Aleutian Island Risk Assessment. The AIRA was a comprehensive study of the risks of petroleum spills from shipping vessels in the Aleutian Island chain. In addition, provided quality assurance oversight of subcontractor consultant technical deliverables.

- Served as Program Manager of a Burned Area Emergency Rehabilitation (BAER) project for the U.S. Fish and Wildlife Service. Managed a team of natural resource (wildlife, vegetation, wetlands and geology/ hydrology) specialists to mobilize and assess the natural resource damage of 4 wildfires (Wautoma, Milepost 17, Bobcat and Upper Goose Wildfires at Mid-Columbia River National Wildlife Refuge, Hanford Monument, Washington) totaling over 70,000 acres in August 2007. The work included collaboration with prime contractor and USFWS staff and preparation of an Emergency Stabilization (ES) Plan and Specifications for each fire. Based on the plans, the Refuge received funding for $12 million in ES measures.

Remote Site Experience

- Managed a treatability study of new technology (Mechano-Chemical Destruction) to destroy polychlorinated biphenyl (PCB) and dioxin contaminated soil at Granite Mountain Radio Relay Station (AFCEE) in central Alaska. The work included mobilizing the equipment to the site, demonstrating and securing permitting from regulating agencies, processing 50 tons of contaminated soil, decontaminating equipment and structures and preparing a report.
- As part of an EPA study of the Fate & Effects of Leachate Contamination on Alaska's Tribal Drinking Water Sources, managed and assisted with the installation and sampling of groundwater monitoring wells at rural Alaska villages (Eek and Ekwok). Work included mobilizing equipment and personnel to the sites and consultation with local community representatives and training.
- Managed a site characterization of a 2,000 gallon diesel fuel spill at Duncan Canal, a remote mountaintop AT&T repeater site in southeast Alaska. Mobilized to the site with ADEC Spill Response and U.S. Forest Service staff sampled media and prepared a characterization report.

Prior to joining ENVIRON, Mr. Coppel held the following positions:

URS Alaska, Deputy FERC Lead, Alaska Pipeline Project, 2012

ERM West, Inc., Senior Consultant, 2010 - 2012

Shaw Alaska, Operations Manager, 2008 – 2010

Shaw E&I, Client Program Manager, 2005 - 2008

Self-Employed Environmental Consultant, 1995 – 2005

Pacific Northern Oil (PNE, Environmental Subsidiary) 1992 – 1995

CH2M HILL, Hazardous Waste Specialist, 1989 – 1992

REGISTRATIONS & CERTIFICATIONS

Alaska Department of Environmental Conservation Approved Sampler

Hazardous Waste Operations (40-hr, Annual Refresher, and 8-hour Supervisor)

Domoni Glass, MS

Manager

Seattle, Washington
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Domoni Glass is a fisheries biologist with over 25 years of experience in natural resource assessment and management, particularly managing large interdisciplinary programs. Domoni has worked extensively in Alaska for the oil industry and other clients, including conducting marine mammal surveys in the Chukchi Sea for Shell and management of a large environmental impact assessment project on the North Slope of Alaska. She has supported various industries through permitting and environmental compliance processes, including working with federal, state and county agencies, tribes, to facilitate those processes. Domoni has be extensively involved in the development of water quality management plans (TMDLs), basin-wide water quantity planning, watershed analyses and watershed planning, endangered species protection, mitigation planning, NEPA/ CEQA compliance documents, FERC permitting and other project permitting and various other related efforts. She frequently facilitated agreements among local, state and federal agencies and affected stakeholders for a variety of projects, including several highly controversial efforts.

EXPERTISE

Endangered Species Act

Conservation Planning

Water Resource & Watershed Planning

Fisheries and Aquatic Habitat

Water Quality

CREDENTIALS

Graduate Studies, Natural Resource Management, University of Washington

BS, Fisheries Biology, University of Washington

EXPERIENCE HIGHLIGHTS

- *Marine Mammal Surveys, Chukchi Sea:* Conducted surveys of marine mammals (primarily walrus and seals) in the northern Chukchi Sea. Documented behavioral reactions to oil drilling activities.
- *Manager, Endicott Environmental Monitoring Program Aquatic Resources Evaluations.* Principle investigator and discipline manager of aquatic resource studies conducted on Alaska's North Slope.
- *Yukon Delta Fisheries Investigations;* Data analyst and field investigator for project designed to determine the distribution and movement timing of key salmonid species on the Yukon delta and in the lower Yukon River and to identify regions and period that fish species would be most sensitive to oil exposure.
- *Wood River Lake Fisheries Investigations, Alaska:* Project involved the enumeration of escapement of mature sockeye salmon into the lakes region, monitoring of prey concentrations and limnology in juvenile sockeye rearing areas, and monitoring the growth and distribution of juvenile salmon in the region
- *Private Oil Development Company*. Provided evaluation of permitting risks related to the development of a northern gas pipeline (confidential).
- *Private Oil Development Company in California*. Completed an assessment of proposed oil drilling in southern California on water quality and hydrology. The project includes fracturing of the underlying rock. The assessment was completed in compliance with the California Environmental Quality Act (CEQA), California's process which is similar to the NEPA/ SEPA process.
- *Private Biofuels Facility in California*. Developed wastewater and stormwater alternatives for a private biofuels project. Completed assessment of impacts of project on hydrology and water quality. Completed assessment of potential project effects on fish species listed under the Endangered Species Act. Contributing to the NEPA review of the project.

- *Manager, Kelso-Beaver Natural Gas Pipeline Project.* Project manager for an interdisciplinary interstate gas pipeline project in Oregon and Washington. Evaluated project effects and completed an Environmental Report summarizing project effects, a Biological Assessment in compliance with the Endangered Species Act, the EA (which was adopted by FERC) as well as all activities associated with completing the state and local permitting process.

- Review of EPA Watershed Assessment for the Proposed Pebble Mine: Domoni completed a review of EPA's watershed assessment and provided technical comments on the draft document.

- *Cascade Reservoir TMDL– North Fork Payette River, Idaho DEQ and EPA*: Domoni Glass managed a watershed analysis and participated actively with the development of the TMDL addressing phosphorus inputs into a reservoir. Land uses addressed included timber extraction, grazing, agriculture, urban (including stormwater and wastewater management), recreation (destination ski facility), and rural residential development. The watershed analysis quantified natural background inputs of pollutants into the water bodies in the project area and assessed the impacts of changes in inputs on fisheries and aquatic organisms. The analysis included the development of a set of best management practices that minimized or avoided potential impacts of land use management on fish and water quality and also assessed the potential improvements associated with various mitigation options. Presently, the EPA is touting this project as one of its major success stories in water quality improvement.

- *Habitat Conservation Plan Compliance; Watershed Analysis, California*. Ms. Glass co-managed a highly controversial project focused on implementing Pacific Lumber Company's habitat conservation agreement for management of their redwood forests in California. Through this process we worked with a group of landowners, environmental groups, and state and federal regulatory agencies to develop watershed analysis methods to be applied on Pacific Lumber Company lands. Ms. Glass facilitated meetings and discussions working towards consensus of this diverse group. Agreement was reached and the detailed methodology was published. The methods included assessment of resources and development of a management plan that minimized or avoided adverse impacts to aquatic resources and selected wildlife species. Methods were then implemented in a watershed containing old growth redwood forests.

- *Washington Department of Natural Resources Watershed Analyses.* Domoni participated on technical committees that developed the Washington Department of Natural Resources watershed analysis methods which are based on robust, scientifically based information regarding watershed processes. The methods focus on addressing timber extraction, but also include effects of other land uses. Domoni assisted with the completion of studies to support the analysis methods and implemented the methods over in numerous watersheds throughout the State of Washington as well as some watersheds in Oregon.

- *Washington Department of Ecology Watershed Assessment Process*. In 1997, the State of Washington adopted the state's Watershed Assessment Act which expanded watershed analyses to all land uses and was specifically focused on assessing land use effects on water quantity, water quality, and fish habitat. For each analysis, a management plan is developed that identifies BMPs, land management constraints, and restoration actions which address the land uses significantly impacting water quality and habitat. The management plans are also intended to ensure that water is available to fill demand into the future. A statewide programmatic EIS was developed for the watershed program. Domoni completed the sections of the assessment for that EIS addressing water quality, water quantity, and fish habitat.

- *Klickitat River Watershed Assessment and Watershed Management Plan*. Domoni managed the watershed assessment and watershed plan development for the Klickitat River basin. This effort followed the guidelines developed under the State of Washington's Watershed Assessment Act. Domoni coordinated the assessment of water use, water available for allocation, water quality, and fish habitat quality for the watershed. She also facilitated the development of a basin Management Plan addressing identified aquatic issues. Parties involved included representatives of State and County agency, environmental interests, tribes, irrigators, the City of Goldendale, Public Utility Districts, timber industry, grazers, and the public at large. Developed the watershed plan based upon the facilitated agreements. Developed and facilitated several public meetings designed to inform interested parties and acquire feedback from the public at large. Completed SEPA requirements in support of plan approval.

- *SEDMODL*: Managed the development of SEMODL, a GIS based assessment tool used to assess erosional processes in a watershed. The model has been used to support the development of TMDLs in California. A simplified version of the model (known as WARSEM) was developed for the State of Washington and has been adopted as the preferred approach for assessing surface erosion in forested watersheds.

Craig A. Hansen

Senior Manager

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Craig Hansen has more than 35 years of experience in environmental science. He has particular expertise in the Endangered Species Act (ESA) and National Environmental Policy Act (NEPA) arenas, resolving ESA and NEPA technical and policy issues, preparing ESA Section 10 conservation plans and NEPA environmental reviews, and managing project teams. Craig also has project experience in the green/ renewable energy sector, managing project teams preparing pre-licensing study plans, and developing multi-party hydropower agreement provisions and license articles for hydropower licensing applications. Craig's extensive ESA Section 10 experience has emphasized permitting, consultation, species conservation processes and requirements, and obligations of applicants under the ESA and Migratory Bird and Treaty Act. Craig is skilled in preparing all three types of NEPA environmental reviews, as well as SEPA documentation that meets State requirements.

Expertise

ESA Section 10 Incidental Take Permitting

ESA Section 7 Consultation Process & Documentation

ESA, MBTA, MMPA, CWA, NHPA & NEPA Regulations, Policies & Procedures

NEPA Environmental Reviews

Renewable Energy Site Assessment

Federal & State Listed Species Effects Analyses

Species Conservation & Mitigation Strategies Development

Aquatic & Terrestrial Habitat Enhancement, Restoration & Protection

Credentials

MS, Wildlife Management

BA, Physiology & Behavior

RECENT PROJECT EXPERIENCE

- Managed the preparation of the Draft, Public Review, and Final Safe Harbor Agreements (SHA) and environmental assessments (EA) addressing forest management activities for two timber industry clients in Washington. Craig provided consultation and guidance to the clients, while working with the USFWS, state agencies, including Washington SEPA Coordinator, and the client project team. He also wrote major portions of the SHAs and EAs, and reviewed and approved all documentation prepared by the team.
- Assisting two clients in evaluating options under the ESA to provide conservation for Candidate Species that may be impacted by client management activities; the gopher tortoise in the southeastern U.S. and the streaked horned lark in the Pacific Northwest. Craig evaluated the extent of occupancy of the species and potential effects of planned client construction activities, as well as advised the clients on the process and documentation required to prepare a Candidate Conservation Agreement with Assurances (CCAA). Craig is currently drafting the CCAAs.
- Provided advice and guidance to an energy company representing 26 public utilities districts in Washington on technical and policy issues related to development of the 32-turbine wind power project habitat conservation plan (HCP) in Pacific County, Washington. Responsibilities included HCP preparation, advising the client on siting issues, and working with USFWS staff developing mitigation measures for this controversial project. Craig also managed the technical team preparing the project's Draft and Final Environmental Impact Statement (EIS) for the USFWS and Washington SEPA Coordinator, and prepared the environmental baseline and environmental consequences for the vegetation and wildlife sections of the EIS.
- Advising the Washington State Association of Counties and assisting with developing an EIS Alternative for the Department of Natural Resources (DNR) HCP amendment expected to result in a long-term marbled murrelet conservation strategy. Assistance includes commenting on proposed alternatives and shaping an alternative that considers potential impacts to counties that are consistent with DNR trust responsibilities.
- Completed a fatal flaws review and analysis of biological resources potentially impacted by installation and operation of a 122-turbine wind farm and associated transmission line in New South Wales, Australia. Reviewed vegetation and species survey reports, and the project proponent's mitigation measures, to determine the efficacy of the surveys and the ability of the measures to reduce project impacts.

Craig A. Hansen

ADDITIONAL PROJECT EXPERIENCE

ESA

- Working for USFWS, Craig addressed technical and policy issues related to development of the WDNR Forest Practices Regulations HCP. Craig was the USFWS lead for this large, complex project. This HCP covered the WDNR regulatory program addressing forestry activities on 9.3 million acres of private forest land throughout Washington that have the potential to affect aquatic species. Craig was responsible for providing guidance to WDNR, participating in HCP negotiations and development, and writing HCP sections.

- Working for USFWS, Craig negotiated the WDNR State Trust Lands HCP, which addressed forest management activities and all species on 1.8 million acres of forest land in western Washington. As project lead, Craig developed and negotiated the HCP and the Implementation Agreement. He also wrote large portions of the ESA Section 7 BO and conducted a quality control review of the ESA Section 10 Statement of Findings.

- Working for USFWS, Craig assisted the forest landowner in Lewis County, Washington, as the lead biologist for USFWS, in developing and preparing the first multi-species HCP in the nation. This HCP addressed all species that could occur on the forested ownership. Since this was the first HCP in the Pacific Northwest, Craig was involved in resolving many issues related to the HCP process itself, prior to the issuance of the HCP Handbook by USFWS.

- Working for another firm, Craig provided a quality control review of a draft BA for structure, content, and clarity to ensure it will meet USFWS and NMFS standards. The BA addressed emergency floodplain management activities in Pierce County, Washington conducted in response to flood damages and their potential impacts on listed fish. The BA was prepared for future submission to FEMA to obtain reimbursement funds for emergency revetment repairs.

- Working for another firm, Craig conducted an effects analysis of noise impacts on marine mammals known to occur in the Columbia River, as well as providing all the information required for submittal of an Incidental Harassment Authorization to NOAA Fisheries under the MMPA. This was part of a comprehensive impacts assessment for the Columbia River Crossing I-5 Bridge conducted for WDOT and ODOT.

NEPA/ SEPA

- Working for another firm, Craig managed the technical team and prepared the Radar Ridge Wind Project Draft EIS. USFWS was the lead NEPA agency for this project. Craig also prepared the environmental baseline and environmental consequences sections for the vegetation and wildlife resource sections. His responsibilities included coordination with BPA, USFWS, Energy Northwest (proponent), as well as other interested parties.

- Working for another firm, Craig conducted and wrote the environmental baseline and effects analyses for 12 species of amphibians, reptiles, and birds affected by WDNR management activities on their aquatic lands. He was a member of the EIS development team preparing a draft EIS for the WDNR's statewide aquatic lands HCP.

- Working for USFWS, Craig addressed technical and policy issues related to preparation of the WDNR Forest Practices Regulations HCP EIS. Craig was the USFWS lead for the EIS that addressed effects of the WDNR regulatory program regulating forestry activities on 9.3 million acres of private forest land throughout Washington that have the potential to affect aquatic species. Craig coordinated closely with the State SEPA Coordinator, and was responsible for writing EIS sections, and co-managing the EIS development team with NMFS. Extensive evaluations of aquatic and riparian habitat were conducted for key fish species including anadromous salmonids and all native fish.

ENVIRON

Felix C. Kristanovich, PhD, PE | Manager

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Dr. Felix Kristanovich has over 20 years of experience in water resources engineering, including hydrologic and hydraulic analysis and modeling. Felix has been a lead hydraulic engineer on streamflow restoration projects and wetland mitigation sites and rivers. He has performed flood insurance studies and prepared dam design documents; developed models for watersheds and streamflow systems and sediment transport; and has evaluated hydrologic impacts of climate change on flows and sediment transport. Felix has organized and implemented water quality monitoring programs, coordinated field investigations for hydrologic reports, conducted environmental impact studies and provided water quality modeling of pollutants from various developments. He has designed shoreline protection against wind waves, ship waves and river currents. He served as lead engineer in the development and application of stormwater master drainage plans for the Port of Seattle Third Runway. Felix is a registered professional engineer (civil), and registered as a CFM by the Association of State Floodplain Managers. He is actively involved in the American Water Resources Association (AWRA), where he helped organize the 2005 and 2009 AWRA conferences in Seattle.

EDUCATION

1988 PhD, Civil Engineering, Louisiana State University

1982 MS, Civil Engineering, CALTECH

1980 BS, Civil Engineering, University of Zagreb

EXPERIENCE

- Chehalis Floodplain Evaluation, Chehalis Confederate Tribes, Oakville, Washington, 2011. As a chief hydraulic engineer, estimated impacts of (a) construction of new culvert structures under the existing levee road, and (b) removal of the old road - on the existing base flood elevations and flow velocities. These impacts were assessed by modifying the Chehalis HEC-RAS hydraulic model and its components.
- Valsetz Water Storage Study, Valsetz, NW Oregon, 2010-2011. Provided comparative evaluation of three different reservoir alternatives with respect to reservoir temperature stratification, and impact on reservoir withdrawals on downstream in-stream flows in Siletz River and on its temperature regimes. Developed the CEQUAL-W2 reservoir/ channel model and QUAL-2K water quality model to assess changes in temperature and hydraulic regime of impacted streams and habitats. Provided recommendation of diversion impacts to Luckiamute River watershed with respect of increased erosion and changes in flows and temperature.
- Rock Creek Sediment Transport Evaluation, Klickitat County, Goldendale, Washington, 2010. Evaluated impact of sediment transport and channel stability on several reaches of Rock Creek using sediment capacity mode of the HEC-RAS model. Advised the County on feasibility in restoration of several creek reaches.
- Alaska Power and Telephone, Port Townsend, Washington (2010). Provided hydraulic dam (spillway and outfall canal) design against Probable Maximum Flood (PMF) for Soule River Hydroelectric dam near Hyder, Alaska. Provided hydrologic design and quality control for Yerrick Creek hydroelectric project near Tok, Alaska.
- Hydrologic and Hydraulic Evaluation of Flooding at Stillman Pond, 2010-2011, General Electric, Bridgeport, Connecticut. Developed and calibrated hydrologic model HEC-HMS to the flows measured at tributaries to Stillman Pond. Calibrated hydraulic model HEC-RAS and simulated several potential future development

scenarios. The future conditions included several mitigation measures to reduce flooding impacts at Stillman Pond. Evaluated impact of the Stillman Pond dam removal on downstream properties.

- KPFF/ King County, May Creek Sediment Transport Study, Bellevue/ Newcastle, Washington (2007-2008). As the main hydraulic engineer, updated HEC-RAS model for several reaches of May Creek. Obtained input to the model using GIS through HEC-GeoRAS. Sediment data collected during the 2007-2008 winter season was used in sediment simulation of the RAS model. Simulation showed equilibrium between areas of deposition and erosion, except for deposition immediately downstream of 148th Street.
- Foster Creek Conservation District, Storage Feasibility Study of Jameson Lake, Douglas, Washington (2006-2007). Developed and calibrated HSPF hydrologic model that simulates surface and groundwater hydrology of McCarty Creek, Jameson Lake and Moses Coulee. Evaluated impacts of several alternatives in order to lower Jameson Lake water levels, such as new outlet structure at the Lake outlet, diversion of McCartney Creek, and an off-channel infiltration facility.
- Nevada Irrigation District, Yuba-Bear PMP and PMF studies, seven dams in California (2006-2007). Conducted PMP and PMF hydrologic and hydraulic analyses in order to re-evaluate safety of seven Yuba-Bear System reservoirs: Bowman Reservoir, Dutch Flat Forebay and Afterbay, Faucherie Lake, French Lake, Jackson Lake, Jackson Meadows, Sawmill and Rollins Reservoir. The studies were based on the updated National Weather Service (NWS) Hydrometeorological Reports (HMR) 58 and 59.
- Berger/ ABAM Engineers, Inc., Port Kalinga Sediment study, Dhamra, India (1997-98) - Developed hydrodynamic tidal circulation (RMA2) model and sediment transport (SED-2D) model to evaluate impact of the construction of the port and its jetty on overall circulation and sediment transport at the mouth of the Dhamra River on the India's eastern coast. Also developed a one-dimensional numerical model GENESIS to simulate changes in the shoreline due to the construction of the port jetty. Optimized jetty configuration and recommended to the international client the port and jetty with the minimum impact on the river flow and sediment erosion/ deposition
- Malcolm-Pirnie and US EPA, Berry's Creek Study Work Plan, Environmental Modeling Framework Support: Assessment of Modeling Complexity, Recommendations on Approach, and Preliminary Data Requirements (2004). Developed study work plan and alternative modeling approach to address EPA Modeling Framework for Berry Creek study area. The study plan included modeling framework, evaluation of modeling complexity, and comparative evaluation of current watershed models, hydrodynamic models, water quality models, and toxics fate models.
- Parametrix/ King County, King County Normative Flow Study, King County, Washington (2002-2003). Managed development of hydrologic-ecological (HE) model that relates ecological and hydrological variables in order to estimate impact of anthropogenic alterations in the watershed on the survival of fish in various King County streams. The Indicators of Hydrologic Alteration and Range of Variability approaches were used to identify several testing sites for the HE model development. This model has been used as a decision tool for the salmon-related management activities in the County.

ENVIRON

Glenn Mills, EP (CEA) | Principal Consultant

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Glenn Mills provides sustainable development, environmental management and quality management planning and consulting services for international mining, industrial and governmental clients. He has more than 35 years' professional experience and has managed and/ or contributed technically to a diverse range of projects in Chile, Guatemala, Suriname, Canada, United Kingdom, Italy, Romania, Bulgaria, Kazakhstan, India, Indonesia, Japan, Russia, China and the US. Specific areas of expertise include design, development and integration of environmental, health and safety, social, and quality management systems, as well as environmental/ due diligence auditing, international social and environmental impact assessment, social and environmental impact mitigation planning, and supply chain quality management. He is an International Cyanide Management Code lead/ technical auditor for precious metal mining operations using cyanide extraction processes and is a Canadian Environmental Certifications and Approvals Board-certified environmental professional/ compliance auditor. Glenn is also an experienced quality program manager and lead quality auditor, with substantial experience in nuclear, marine, aerospace, industrial and environmental quality management system implementation.

EDUCATION

BA, History, University of Washington

EXPERIENCE

Mining Industry

- Independent Environmental, Social, Health, and Safety/ Health, Environmental, Safety, and Community Relations (ESHS/ HESC) audit of the Aurora Project, for Guyana Goldfields, Inc., Canada and Guyana: Conducted an independent audit of exploration/ early works construction phase activities of the client's Aurora gold mining project in northwestern Guyana. The audit was conducted to assess the general adequacy of current ESHS/ HESC practices with respect to international best management practices and current IFC guidelines, and included the development of specific recommendations for practice improvements.
- Sustainable Development Policy Support and Implementation Audit, Anfield Nickel Corporation, Mayaniquel Project, El Estor, Guatemala: Provided technical guidance to Mayaniquel, S.A. in the development of corporate policies to support the sustainable development of a large laterite nickel exploration project in the vicinity of Lake Izabal in eastern Guatemala. Developed final iterations of the client's sustainable development and community relations policies, along with an integrated health, safety, and environmental policy and an underlying company charter, mission statement, and general business principles. Conducted an initial annual onsite audit of policy implementation using ISO 19011-based environmental/ quality audit methodology. Prepared comprehensive audit report and recommended action items as necessary to fulfill the intent of underlying EHS and sustainable development policies, as well as strategic recommendations for development of mitigation plans, standard operating procedures, and other social, environmental, and health and safety management planning documents as necessary to properly support the preliminary phases of project development, as well as eventual construction, operation, and concurrent restoration.
- 2005 External Environmental Audit, Grasberg Mine; PT Freeport Indonesia Company (PTFI)/ Freeport-McMoRan Copper & Gold, Inc. (FCX), Papua, Indonesia: Served as lead auditor with overall responsibilities for planning, co-ordination, and documentation of a broadly focused EMS, compliance, and technical mining practices audit for FCX and PTFI, benchmarked to ISO 19011 EMS/ QMS auditing guidelines. The audit was conducted in compliance with the terms of PTFI's Contract of Work with the Government of Indonesia. The audit team consisted

of senior international and Indonesian consultants with specific expertise in Best Management Practices (BMP) evaluations for major gold mining operations, management of tailings and overburden, EMS auditing, environmental impact assessment, and Indonesian regulatory compliance requirements.

- ICMC Pre-audits of Mining Operations and Readiness Reviews of Producers/ Transporters, Eldorado Gold, Peoples' Republic of China: conducted ICMC pre-audits of four mining projects in Heilongjiang, Jilin, Qinghai, and Guizhou provinces. Provided guidance to ENVIRON Beijing EHS auditors in conducting ICMC readiness reviews of 14 indigenous cyanide sales agents, transporters, and producers. Provided strategic recommendations to the client with respect to cyanide management practice improvements and ICMC certification.
- ICMC Preassessments, Certification Audits, and Recertification Audits, Kinross Gold - Operations in Nevada, Alaska, Washington, Chile, Ghana, and Russia: Project manager and ICMI-approved technical auditor for a series of preassessments, certification audits, and recertification audits of cyanide-based gold extraction processes at six Kinross Gold Corporation mine sites in Chile, Russia, and the US. Responsible for selecting and pre-qualifying audit teams in accordance with ICMC requirements as well as for planning and executing audit elements primarily associated with cyanide procurement, transport, receipt, and storage; mineral processing; decommissioning and closure of cyanide facilities; and community relations; and for managing ICMI submittal, review, and approval processes applicable to draft and final detailed and summary audit reports.
- ICMC Design Review Services, Kinross Gold – Tasiast Mine, Mauritania: Provided technical assistance in the evaluation of ICMC requirements applicable to the design of a new processing plant, tailings facility, cyanide storage facilities, and associated cyanide management infrastructure currently being developed for Kinross's Tasiast gold mining project in western Mauritania.
- Kinross Gold Corporation – USA, Reno, Nevada; Provided on-call technical review, assessment, and consulting services to support the refinement and update of corporate standards, guidance, and other practice documents comprising the Kinross Corporate Responsibility Management System.
- Environmental and Social Management System (ESMS) Planning and Implementation Support Services, Guyana Goldfields, Inc., Canada and Guyana; developed draft ESMS Management Plan, selected Action Plans, and a suite of supporting standard operating procedures for the exploration/ early works construction phase of the Aurora gold mining project on the Cuyuni River in northwestern Guyana. Documents were developed in accordance with World Bank/ International Finance Corporation (ICF) performance standards and mining sector guidelines, as well as best management practices drawn from ISO 14001, OHSAS 18001, and the Prospectors & Developers Association of Canada (PDAC) e3-Plus "tool-kit."
- EMS Development Services, Endako and Thompson Creek Molybdenum Mines, British Columbia and Idaho; Thompson Creek Metals, Inc., Colorado: Provided project scoping support to client management with respect to EMS concepts and international best management practices, including integration of sustainability-related performance indicators derived from the Mining Association of Canada's "Towards Sustainable Mining" (TSM) initiative. Led a project scoping workshop involving representatives from operating mines and a specialty molybdenum products refinery, and assisted operating mines in the design and documentation of EMSs and supporting procedures based on ISO 14001 and current and anticipated TSM protocols.
- International Cyanide Management Code Pre-audit Assessment, Certification Audit, and Recertification Audit, AngloGold Ashanti Colorado: Project manager for a pre-audit assessment and certification audit of cyanide-based gold extraction processes at an operating mine site in Colorado. Responsible for preassessment, as well as selecting and pre-qualifying audit teams in accordance with ICMI requirements. Responsible for the planning and execution of audit elements primarily associated with cyanide procurement, transport, receipt, and storage; decommissioning and closure of cyanide facilities; and community relations; and for managing the final submittal of detailed and summary audit reports to the ICMI.

ENVIRON

Laura J. Noland | Senior Manager

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Laura Noland is a Senior Manager and Senior Environmental Scientist in ENVIRON's Anchorage, Alaska office. Laura has 20+ years of consulting and regulatory experience in Alaska and is highly regarded by her clients for her understanding of arctic environmental conditions, the ecology, and the unique federal and state environmental regulations governing Alaska. Prior to her consulting career, Laura worked for 10 years at the State of Alaska Department of Environmental Conservation where she managed contaminated sites investigation and remediation projects throughout the northern half of the state. Laura has worked extensively with the Department of Defense agencies addressing the cleanup of remote arctic sites such as White Alice Sites, Dewline Sites, and former and current USAF Stations. Currently Laura is managing assignments with two of the world's largest oil companies addressing air quality permitting and biological assessments in the Arctic region. Additional projects include oversight of permitting and ecological assessment work for several hydroelectric power companies seeking to build new power generation facilities throughout the state.

EDUCATION

1990 MS, Professional Technical Writing Coursework, University of Alaska-Fairbanks

1986 BS, Natural Resource Management, University of Alaska-Fairbanks

1982 AA, Environmental Science, Anchorage Community College

EXPERIENCE

- Participated in the development of an Exploration Plan & Environmental Impact Assessment, for Arctic offshore oil and gas development project. Responsible for overall quality and control of draft EIA and EP and working as team member with nationwide subject matter experts, facilitated preparation of the Draft EP and EIA and conducted senior technical review. Researched oil spill response logistics and techniques in remote arctic environment and hazardous waste management options in remote camps and support vessels.
- Participated as a team member working with environmental professionals, and specialty contractors preparing permit applications, plans, and assisted with logistical planning for the plugging and abandonment of oil and gas exploration wells and associated infrastructure on the North Slope of Alaska. Permit applications included North Slope Borough Land Use Permit; BLM Plan of Operations; USFWS Polar Bear Den Avoidance Plan; ADEC Temporary Camp and Waste Water Permit; and Waste Minimization Plan.
- Served as project manager and working with a team of environmental professionals, prepared an EA in accordance with Department of Interior agency policies, for the rehabilitation of the Denali NP HQ Area Utilidor System within the 11.91 acre Park Headquarters Historic District. Development of alternatives considered performance, cultural, environmental, and financial advantages and impacts for each alternative.
- Served as project manager designing and implementing Environmental and OSHA Compliance Matrix for large-scale gold mining operation located in northwest Alaska. Identified all applicable regulatory requirements and compliance timelines and commitments including: Alaska Coastal Zone Consistency Analysis, SHPO, Pre-operational, Operational, and Closure Monitoring Plan; Waste Water, Title 41; Air Quality Permits, SPCC, USACE 404 and 401, SWPPP, solid waste, and injection wells; and designed database for site personnel to track and adhere to compliance and regulatory commitments.

- Served as project manager for the development and implementation of an Environmental Management System (EMS) in accordance with ISO 14001 for an army base and a missile defense site in northern Alaska for a defense contractor. EMS includes all aspects of NEPA and permitting requirements including drinking water, waste water, natural resources, solid waste, contaminated sites, RCRA, and waste management. The process of developing the EMS included numerous work group meetings with defense contractors, army and missile defense base personnel, and base commander.
- Served as project manager for the State of Alaska Solid Waste Program; responsibilities included solid waste planning and permitting for Fort Greely, Fort Wainwright, Fairbanks North Star Borough and Barrow Landfills, and remote communities, Alaska. Performing as ADEC Project Manager, drafted and issued solid waste disposal permits for Class I and II landfills throughout northern Alaska, including Army CERCLA landfills, remote Air Force landfills in accordance with RCRA, and state regulations. Reviewed and approved groundwater monitoring and sampling plans, quality assurance / quality control proposals, and statistical analysis reports. Integral in drafting the state's solid waste regulations and researching environmental issues such as contaminated soils disposal, and other waste issues.
- Served as an active participant in the development of the State of Alaska Solid Waste Regulations, which particular emphasis on contaminated soils disposal in landfills.
- Served as a member of the Fate and Transport Modeling Work Group and assisted in the development of official state guidance for fate and transport modeling.
- Served as contract and project manager on a multi-year project working with a team of environmental specialists, conducted a facility-wide contaminated site assessment/ risk assessment program for an international airport located in Anchorage, Alaska. Project scope included the installation of approximately 110 soil borings and 30 monitoring wells airport-wide. Conducted ecological and human health risk assessment with the purpose of developing area-wide alternative cleanup levels (ACLs) based on the risk zone approach. Conducted extensive fate and transport modeling, groundwater modeling, and vadose zone modeling to provide site-specific environmental parameters. The resulting *Contaminated Site Corrective Action Airport-Wide Risk Management Plan* continues to serve as a tool for airport management, and airport tenants to facilitate cleanup activities and site closure.
- Performed as project manager for State of Alaska, Contaminated Sites Program with oversight of multiple subcontractors directing the design of an area-wide groundwater sampling and investigation program to determine the source of chlorinated solvent groundwater contamination detected in the upper and lower drinking water aquifer at concentrations exceeding drinking water standards in an area potentially impacting the a city's drinking water wells. Provided the Attorney General's Office with information necessary to identify, investigate, and contact potential responsible parties. Initiated cost recovery action in accordance with CERCLA, and state cost recovery regulations.
- Serving as project manager for the state of Alaska, provided oversight for the design and study of an aquifer modeling study to identify multiple contaminant sources in an Alaskan municipal area which poses a threat to the community's sole source drinking water aquifer. The study included the identification and evaluation of previous groundwater modeling studies, conceptual hydrogeologic modeling, an evaluation of data gaps and data collection methods, and recommendations for future study.
- Served as Senior Environmental Scientist providing senior level technical and regulatory compliance advice regarding hazard ranking for Superfund site listing for three industrial facilities listed on the EPA's National Priority List in southeastern United States. Conducted confidential CERCLA USEPA Hazard Ranking System (HRS) ranking to identify environmental pathways and contaminants of concern at clients' facilities based on previous environmental technical reports.

Gregory S. Reub

Principal

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Greg Reub is a senior ecologist with over 25 years of experience related to impact assessment, mitigation and restoration of natural resources. Currently, his expertise is focused on integration of science- based strategies to expedite resolution of complex natural resource issues. He has served as project manager in numerous large and small environmental assessments that encompass aquatic, estuarine, marine, riparian and terrestrial environments; as lead and contributing scientist; technical negotiator; and as an expert witness. Greg has extensive experience related to ecosystem services analysis, environmental and social impact assessments, natural resource damage assessments, habitat restoration, landscape-level conservation planning, Endangered Species Act (ESA), compliance and environmental assessments and permitting. His projects have focused on determining physical and/ or chemical impacts to habitats, and developing innovative restoration and conservation measures for cost effective resolution. Greg is well-known for developing and working with interdisciplinary teams to solve interrelated issues ranging from physical and biological relations such as instream flows, fish passage, water and sediment quality, geomorphic changes and vegetation interactions to the social, cultural and political realities associated with natural resources.

Expertise

Ecology, Aquatic Biology & Fisheries

Natural Resource Damage Assessment

Ecological Valuation & Ecosystem Markets

Habitat Restoration

Conservation Planning & Endangered Species

Environmental Impact Assessment & Mitigation

Credentials

MA, Ecology & Systematic Biology, San Francisco State University

BS, Wildlife & Fisheries Sciences, Minor in Chemistry, South Dakota State University

American Fisheries Society

American Water Resources Association

Hazardous Material Handling Training

Watershed Assessment Certification: WSDNR

EXPERIENCE HIGHLIGHTS

- Conducted numerous Natural Resource Damage Assessments (NRDAs) as project manager, technical lead and/ or expert witness for various chronic (i.e. hazardous waste sites) and catastrophic (i.e. oil and chemical spills) events, including the Exxon Valdez oil spill (Alaska), Tampa Bay oil spill (Florida) and Pt. Wells oil spill (Washington), as well as various barge and truck spills.
- Developed several landscape-level habitat conservation plans (HCPs) and other ESA compliance documents, including an HCP for the state of Washington for 2.4 million acres of aquatic lands, the Puget Sound Prairie Species Candidate Conservation Plan, Russian River programmatic biological assessment and the Geoduck Consortium Programmatic BA, among others. Authored an innovative model to quantify ecological effects and benefits to species for planning purposes.
- Served as technical lead or project manager for 13 Federal Energy Regulatory Commission (FERC) hydroelectric licensing or relicensing projects across the Continental US and Alaska.
- Accumulated extensive experience in environmental assessments of oil and gas development projects, from field biologist to project manager. Involved in numerous oil field exploration and development programs from the North Slope of Alaska to Bolivia in Latin America. Assisted or managed several large oil and gas pipeline projects in Alaska, Canada, the Continental United States, Bolivia and Ecuador.
- Served as project manager, Aquatic Investigator, and named as Expert Witness for the Blackbird Mine Natural Resource Damage Project and Restoration Plan focused on an action to recover damages for injuries to natural resources caused by the release of hazardous substances from a mine in Idaho.
- Project Manager/ Assistant Program Director for Exxon Valdez Oil Spill Biological Programs for herring, crustacean and bottom fish resources and also advisor for the salmon studies. These studies were a major part of an extensive series of biological studies for the Natural Resources Damage Assessment of the

effects from a major oil spill in south central Alaska.

- Served as fisheries lead and co-author for a set of documents developed for Department of Fisheries and Oceans, Canada to assist in protection and restoration of impacts from placer mining in the Yukon River basin. These documents provide guidance for on-the-ground protection and restoration of aquatic resources that can be implemented by the independent mining operators.
- Served as Biological Task Lead for evaluation of construction, operation and abandonment impacts and mitigation for two large diamond mines in the Northwest Territories in Canada. The Sable, Pigeon and Beartooth Developments are proposed by BHP Billiton Diamonds Inc. and the Snap Lake development by De Beers Canada Mining Inc.
- Project Manager for Marine Environmental Studies in northern Chile, South America to determine potential impacts and site location for a major copper transport facility in Caldera Bay, Chile, part of the Candeleria Copper Mine Project, Port Facilities. The focus of the studies includes establishing baseline conditions and long-term monitoring for biological, chemical and toxicological aspects of the water, sediments, and biota.

  Lead Aquatic Biologist in the assessment of natural resource damages from a major mine tailings spill in the Philippines. Tailings from a major gold and cooper mine operation were deposited several feet in depth from the mine in the mountains throughout a river valley and into the ocean. This project involved assessing natural resource and human health claims in the affected river and near shore environments.
- Participated in or directed the field collection, laboratory analysis, and data evaluation for Cerrejon Coal Mine Project, Colombia. Led the technical efforts dealing with major impacts such as the diversion of a major river in the area of the proposed mining facilities and assisted in marine studies for development of a deep water port. This mine was planned as one of the largest open pit coal mines in the world.
- Endicott Environmental Monitoring Program, Prudhoe Bay, Alaska. Responsible for water quality, fish and invertebrate distribution, and abundance and fish overwintering programs for Endicott Environmental Monitoring Program. These studies study involved monitoring and impacts determinations due to oil field development
- Waterflood and Lisburne Developments, North Slope, Alaska: Served as fisheries field team leader and assisted in database management, analysis and report preparation for two large oil field development environmental studies in the Prudhoe Bay area of Alaska. These involved both offshore and nearshore studies for the Waterflood Environmental Monitoring Program and the Lisburne Development Environmental Studies.
- Bradley Lake Hydroelectric Project Licensing, South Central Alaska: This project involved field data collection, analysis and report writing for development of the fisheries portions of the application. Primary author for the FERC Exhibit E (fisheries portion) for the Bradley Lake Hydroelectric license application.
- Chakachamna Hydroelectric Licensing Project, South Central Alaska: This alternative to the Susitna Hydroelectric Project involved field data collection, analysis and report writing for development of the fisheries reports.
- Eight Fathom Bay and Ushk Bay Timber Sale EIS, Southeast Alaska: Interdisciplinary Team Leader for fish and wildlife resources and Fisheries Principal Investigator for this EIS in southeast Alaska. Responsible for data collection and analysis and reporting to describe the affected environmental and potential impacts/ mitigation for different timber harvest scenarios. This multi-basin project focused on sediment production and effects on aquatic life. Study areas are over 200 square miles. He co-authored a watershed assessment methodology to predict impacts and watershed sensitivities related to timber harvest alternatives.

ENVIRON

Jeri Sawyer, MS | Senior Manager

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Jeri Sawyer is an economist and senior manager at ENVIRON with more than twenty years' experience in various types of economic analysis, including regulatory review, linear environmental and economic analysis, and other related environmental impact analyses. She is highly proficient in power and recreation analysis. Jeri has proven experience in technical and economic analysis for environmental- and energy-related analyses. In addition, she has increasing experience with recreation demand analysis, recreational site assessments and inventories, economic impact analysis, agricultural economic analysis, and population forecasting.

EDUCATION

1993 MS, Economics, Portland State University

1988 BS, Agricultural Economics, Washington State University

EXPERIENCE

Regulatory Review

- Regulatory Impact Review (RIR)/ 4(b)(2) Preparatory Assessment/ Initial Regulatory Flexibility Act Analysis (IRFA) for the Critical Habitat Designation of Cook Inlet Beluga Whale, Alaska. Jeri provided economic and energy analysis for the potential impacts to various land and water uses due to the proposed designation of critical habitat for the listed Cook Inlet beluga whale. The analysis measured effects on commercial fisheries, Alaska Native and subsistence use, oil and gas development, mining, transportation and other large scale development/ infrastructure projects, port expansion and development, wastewater discharge, wind, tidal and geothermal power development, recreation and tourism, military activities, and educational, scientific and non-consumptive use. The report also analyzes the use and non-use benefits of the proposed critical habitat designation of Cook Inlet beluga whale in Alaska. Sources of potential benefits include, among others, subsistence fishing activities in Cook Inlet and subsistence hunting of Cook Inlet beluga whales by Alaska Native Corporations and communities.
- Economic Analysis of Critical Habitat Designation for the Kootenai River Population of the White Sturgeon (Acipenser transmontanus). Jeri was on the team conducting an economic analysis to address the costs associated with listing the Kootenai River White Sturgeon as endangered and designating critical habitat. The study is intended to give guidance as to the total and relative cost of designating areas as critical habitat. Jeri focused on the power impacts related to the Libby Dam, located in Montana, collecting data, and analyzing retrospective and prospective costs. Jeri developed a series of draft analyses and helped prepared the draft report for public review and comment. Upon receipt of public comments, Jeri prepared responses to the energy-related comments.
- Oil Transfer Rule Small Business Economic Impact Statement & Cost Benefit and Least Burdensome Analysis (Washington State DOE) Olympia, Washington. The Washington State Department of Ecology Spill Prevention, Preparedness, and Response Program (SPPRP) revised rules that govern the transfer of oil within Washington State waters. As part of the rulemaking process, several economic analyses needed to be conducted prior to the time that DOE intended to propose the rule. Jeri assisted the effort to complete these analyses, with her focus on the costs associated with changes in notification practices, "pre-booming" procedures, training, and spill prevention and response planning as they related to mid-sized facilities, called "Class 3 Facilities". Her analyses included telephone and personal interview with the facilities' management,

data gathering and management, and cost development. She also participated in the report preparation for the Class 3 Facilities.

Linear Environmental Analysis

- Harney County 230-kV Transmission Line and Wind Farm EIS. Jeri provided economic and energy analysis for a transmission line right-of-way (ROW) that will connect a wind power project in Harney County, Oregon to the existing power grid. The co-clients are green energy development firms, Harney Electric Cooperative & Columbia Energy Partners. The preferred ROW path crosses national wildlife refuge lands under the management of the Fish & Wildlife Service and Bureau of Land Management that are under general management plan direction.

Economic/ Socio Economic Analysis

- Assisting in the development of a web-based information management system that compiles, evaluates, and facilitates access to publicly available data, reports, articles, and geospatial information related to baseline ecological and human use services provided within a large water body.

Other Related Environmental Analysis

- Regional Economic Impacts of Wind Power Development, Harney County, OR. For wind energy developer Columbia Energy Partners, Jeri provided analysis for the economic impact assessment of two proposed wind power projects in Harney County, Oregon. Specific project impacts evaluated included property values and public services. In addition to data collection from project developers and operators, the assessment of these effects included interviews with local service providers and literature reviews.
- Regional Economic Impacts of Wind Power Development, Southeastern WA. For the Southeastern Washington Economic Development Council, Jeri provided analysis for the economic impact assessment of three wind power projects in Columbia County in terms of total jobs, income, and tax revenues generated. The study also included evaluation of potential impacts of future wind projects elsewhere in the region. Specific project impacts evaluated by Jeri included potential effects on property values, the value of agricultural production in the region (opportunity cost of land), and an overall socioeconomic overview. In addition to data collection from project developers and operators, the assessment of these effects included interviews with local real estate professionals and community organizations (chamber of commerce, economic development agencies).
- Long-Term EWA EIS/ EIR Power Impact Analysis, Project Manager. Jeri is the lead economist developing the impact to power production and prices under the various alternatives of the Long-Term EWA EIS/ EIR under contract with CDM. This analysis includes assessing the power model results provided by CDM, which include the energy output of several State- and Federally-operated dams, and determining whether the impacts under each of the alternatives are "significant" or "not significant", as well as determining the impact on power and power prices within the entire project area, located in the central region of California.
- Pelican Butte Ski Area Master Plan EIS: Alpine Skiing Market Analysis. The overall project evaluated the potential market for downhill skiing at the proposed Pelican Butte Ski Area in southern Oregon. Jeri was responsible for population projections by county and age cohort, skier demand analysis, and other economic analysis. She projected population by age cohort in the local and regional market areas, and projected potential participation by selected age cohorts for counties within the market area. Additional analysis she completed was allocation of potential skiers to ski areas within and outside the market area.

Kimberly G. Toal, MA

Associate/ Ecologist

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EXPERTISE

Sensitive Plant and Animal Surveys

Fisheries and Aquatic Habitat Permitting

Endangered Species Act

GIS Mapping

CREDENTIALS

MA Biology (Population Ecology), University of California Riverside

BA Biology, Whitman College, Walla Walla, WA

40-Hour HAZWOPER

38-Hour Army Corps of Engineers Wetland Delineation Program

CEQA Mitigated NegDec and CEQA Basics workshops, Los Angeles, CA

WA Watershed Analysis Training Riparian Module

Kimberly Toal has more than twelve years of experience in terrestrial and aquatic ecology in both Washington and California, with expertise is in rodent population ecology and grassland habitat management. She has worked with government agencies, Native American Tribes, and major utilities conducting field surveys for fish, birds, small mammals and plants, doing project impact analyses, surveying and mapping aquatic habitats, and ensuring project mitigation compliance. She has participated in the preparation of aquatic permits, NEPA/ CEQA compliance documentation including Biological Assessments and Biological Evaluations, mitigation plans, and Section 7 informal consultations. Her experience also includes applying Ecosystem Services analysis to large development projects.

EXPERIENCE HIGHLIGHTS

- Assisted clients in the gas and electric transmission sectors maintain compliance with the U.S. Endangered Species Act, the California Endangered Species Act, the Migratory Bird Treaty Act, and California Fish and Game Code. Coordinated with state and federal agencies to ensure gas pipeline project compliance under a U.S. Fish and Wildlife Service Biological Opinion, and a State of California Memorandum of Understanding for the protection of state-listed species.
- Prepared state aquatic permits for gas pipeline projects throughout southern California, and consulted with the Army Corps of Engineers and California Department of Fish and Game to make jurisdictional determinations for affected waterways.
- Assisted in preparing 401 and 404 permits for a large development project in Southern California with extensive wetland mitigation and construction.
- Coordinated environmental compliance monitoring for client Southern California Edison on the Tehachapi Renewable Transmission Project Segments 1 through 3. Ensured compliance with complex mitigation measures for sensitive species and habitats, and negotiated project variances with state and federal agencies.
- Managed a Tribal water quality program funded by BIA and EPA to assist the Squaxin Island Tribe with developing water quality standards, create a non-point pollution plan, and monitor waters within the Tribe's shellfish growing areas for compliance with federal standards. Reviewed and commented on project proposals within the Tribe's Usual and Accustomed Fishing Area to ensure representation of Tribal interests in aquatic habitat protection.
- Participated in two federal watershed analyses for two coastal river systems in Washington State.

ENVIRON

Richard J. Wenning | Principal

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Richard Wenning is the global leader of ENVIRON's Ecology & Sediment Management practice. He has over 25 years of experience in ecotoxicology, environmental forensics, human and ecological risk assessment, waterfront restoration and investigation, and assessment and remediation of contaminated sediments. He has managed interdisciplinary teams of engineers and scientists for industry clients on several multi-year contaminated waterway assessment and rehabilitation projects in the US and other countries, most notably Arcata/ Humboldt Bay (California), Augusta Bay (Italy), Baltimore Harbor (Maryland), Hackensack River (New Jersey), Homebush Bay (Australia), Kishon River (Israel), Liepaja Harbor (Latvia), Newark Bay and Passaic River (New Jersey), Onondaga Lake (New York), Pallanza Bay and Toce River (Italy), Penobscot Bay (Maine), San Diego Bay (California), Tittabawassee and Saginaw Rivers (Michigan), Upper Calcasieu River estuary (Louisiana) and Venice Lagoon (Italy). Richard has published extensively in the scientific literature on chemical-source fingerprinting, contaminated sediments and risk assessment. He is co-editor of the book, Use of Sediment Quality Guidelines and Related Tools for the Assessment of Contaminated Sediments (2005; SETAC Press), and two books on Environmental Security in Harbors and Coastal Areas (2007; Springer). He currently serves as editor-in-chief of the peer-reviewed journal, Integrated Environmental Assessment and Management and as associate editor of the journal, Archives of Environmental Contamination & Toxicology.

EDUCATION

1987 MEM, Ecotoxicology, Duke University

1985 BS, Environmental Science, University of Denver

EXPERIENCE

Contaminated Sediment Assessment & Remediation

- Preliminary remedy cost analysis and net environmental benefits analysis of five options for managing sediments in the lower 7 km of the Kishon River [2009-present; Haifa, Israel].
- Investigation, preliminary remedy analysis, and net environmental benefits analysis at the Shipyard Sediment Site in Inner San Diego Harbor [2008-present; USA-CA].
- Investigation and assessment of mercury in sediments in Augusta Bay [2006-present; Siracusa, Sicily, Italy].
- Investigation, assessment, and remediation of dioxins in sediments and floodplain soils in the Tittabawassee / Saginaw River and Saginaw Bay [2006-present; USA-MI].
- Investigation of suspended and bedload sediment transport in the Saginaw River [2006-present; USA-MI].
- Assessment of impacts to marine fisheries and projected ecological recovery rates after crude oil spills from tanker vessels and drilling accidents [2005-present; worldwide].
- Peer-review to identify data gaps and improvements in ecological studies and risk assessment methods pertaining to the Tittabawassee/ Saginaw River watershed [2007-present; USA-MI].
- Development of a landscape-level ecological risk assessment strategy for Department of Defense and other stakeholders involved in remediation of the Naval Petroleum Reserves in Southern California [2004-05; USA-CA].
- Development of an Arctic food chain for PFCAs [2005-06; North America].

- Sediment triad assessment of chromium impacts in the lower Hackensack River [2003-07; USA-NJ].
- Evaluation of proposed waterfront development on aquatic habitat in the Kill Van Kull [2005; USA-NY].
- Assessment of fish body burdens and habitat impacts due to mercury in Onondaga Lake [2003-04; USA-NY].
- Ecological scoping study of PCBs in soils and possible effects on an adjacent wetland [2002; USA-CA].
- Review of USEPA's Office of Pesticide Program ecological risk assessment of atrazine [2001; USA-Washington, D.C.].
- Screening-level ecological assessment of dioxins in Casco Bay, Maine [1998, USA-ME].
- Peer-review of proposed Australian ecological risk assessment guidelines [1997; Victoria EPA, Australia].
- Risk assessment of sediments and fish at the Fields Brook Superfund site [1993, USA-OH].
- Development and implementation of a residential sampling program to measure dioxins in soils and indoor house dust along the Tittabawasse River floodplain to support the University of Michigan Dioxin Exposure Study [2004-05; USA-MI].
- Review of USEPA's Office of Pesticide Program ecological risk assessment of atrazine [2001; USA-Washington, D.C.].
- Peer-review of proposed Australian ecological risk assessment guidelines [1997; Victoria EPA, Australia].
- Member and U.S. delegate to the European Commission collaborative action, RISKBRIDGE, charged with addressing risk issues associated with sediment management in different member states [2007-2009].
- Member of the U.S. Army Corps of Engineers scientific peer-review panel charged with technical review of the U.S. ACE Environmental Research & Development Center environmental assessment of direct, intermediate, and long-term environmental consequences stemming from flooding of greater New Orleans, Louisiana, metropolitan area during and after Hurricane Katrina; work contained in April 2006 report titled "Task 9 Environmental Subtask Technical Appendix" [2006].
- Member of the U.S. EPA National Center for Environmental Assessment (NCEA) scientific peer review panel charged with technical review of the scientific and technical merits of the draft NCEA 2004 report titled, "Levels of Polychlorinated Dibenzodioxins, Polychlorinated Dibenzofurans, PCBs and Mercury in Rural Soils of the U.S." [2005].
- Chairperson of the U.S. Army Corps of Engineers & U.S. EPA Region 9 scientific peer review panel charged with review of dredged material disposal options at the Port of Moss Landing, CA; work contained in the draft 2003 report titled, "Evaluation of Environmental Risks and Remedy Alternatives at the Port of Moss Landing, CA" [2004].
- Member of the U.S. EPA Region 2 scientific peer review panel charged with technical review of the ecological merits of the bioaccumulation testing evaluation framework proposed as part of the "Framework for Assessing the Suitability of Dredged Material to be Placed at the Historic Area Remediation Site (HARS) – Human Health Evaluation" [2002-2003].
- Member of the U.S. EPA Region 2 scientific peer review panel charged with technical review of the human health consequences of the bioaccumulation testing evaluation framework proposed as part of the "Framework for Assessing the Suitability of Dredged Material to be Placed at the Historic Area Remediation Site (HARS) – Human Health Evaluation" [2002].

ENVIRON

Charles S. Wisdom, PhD, AICP

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Charles Wisdom, PhD, AICP, is a biologist with 29 years of experience investigating the effects of human activities on water quality throughout the Western United States. During this time, he has supported both public and private client assistance with issues related to water quality, stormwater impacts, NPDES permit compliance, Endangered Species Act Biological Assessments, and NEPA Environmental Assessments and Environmental Impact Statements. Charlie's work in water quality has involved the determination of the toxicity and fate chemistry of metals, the toxicity of polycyclic aromatic hydrocarbons (PAHs) and pesticides, federal and state water quality criteria, and relating the Clean Water Act to the Endangered Species Act. His work on stormwater impacts has involved the assessment of non-point pollutants, application of stormwater management manuals, and pollutant loading analyses. Charlie has assisted public clients with determining compliance with the terms of their wastewater and stormwater NPDES permits, interpretation of permit terms and conditions, the conduct and evaluation of bioassay monitoring, and the assessment of 303(d) Impaired Waters Listings. He has conducted both informal and formal consultations with the National Marine Fisheries Service and the United States Fish and Wildlife Service under Section 7 of the Endangered Species Act and Section 7(d) determinations. Charlie has participated in the preparation of NEPA EAs/ EISs involving Third Party Reviews for the Bureau of Land Management, the preparation of natural environment discipline reports, and the application of risk assessment in EISs.

EDUCATION

1982 PhD, Chemical Ecology, University of California, Irvine

1977 Bachelor of Arts, Biology, University of California, San Diego

1975 Associate of Arts, Biology, Orange Coast College

EXPERIENCE

Ephrata Landfill Feasibility Study MTCA Risk Assessment - Grant County Department of Public Works, Ephrata, Washington

- Charlie is currently leading the Model Toxics Control Act (MTCA) Risk Assessment in support the Ephrata Landfill Feasibility Study. The remedial investigation (RI) effort identified patterns of soil and aquifer contamination for both on-site and off-site locations with groundwater as the primary mechanism for the transport of contaminants throughout the area. Charlie and his team developed screening levels for contaminants present in on-site and off-site soil, groundwater, outdoor air, and indoor air using either MTCA Method B or Method C approaches for on-site workers and off-site residents. The results of the risk assessment will be used in the feasibility study to determine remedial levels in evaluating technological approaches for remediating this site.

Risk Assessment for Pit Lake at Round Mountain Mine – Round Mountain Gold Corporation; Round Mountain, Nevada, USA

- Charlie led a human health and ecological risk assessment (HERA) for Round Mountain Gold Corporation in response to a proposed mine expansion and development of a new mine at the Round Mountain facility in Nevada. As part of the environmental evaluation conducted for the Environmental Impact Statement (EIS), the Bureau of Land Management (BLM) requested that RMGC conduct a HERA, following BLM risk assessment methodology, for two pit lakes that will form following closure of the mine. These risk assessment evaluated whether dissolved metals – such as mercury (both inorganic and organic forms), arsenic, and selenium – leached from pit walls by groundwater, would pose potential risks to wildlife and humans using the future lakes. Since the lakes are not expected to support an aquatic community, nor will they be stocked, potential risks to aquatic life were not evaluated. For these risk assessments, the scenarios evaluated were based on modeled "base case"

data. The development of three habitats was evaluated: littoral, riparian, and upland. Risks to mallard ducks, spotted sandpipers, cliff swallows, little brown myotis (bat), mule deer and humans were predicted for each configuration of lake filling and habitat availability. Concentrations of lake chemicals were defined using the results of a modeling effort that calculated exposure levels for each biological resource. The results of the risk assessment were used in identifying risk management actions that reduced or eliminated risks to the wildlife and human communities.

Assessment of the Ecological and Human Health Risks Downstream from Copper Mining – PT Freeport Indonesia Co., Irian Jaya, Indonesia

- Charlie directed the initial Data Needs Assessment phase of this risk assessment of aquatic life, human health, and a tropical mangrove ecosystem for metals present in surface water resulting from increased operations of a combined gold and copper mine. Traveling to the mine site in Indonesia, Charlie coordinating the assembly of 10 years of sampling results collected by the client and visited the sampling locations and inspected mining operations. Subsequently, Charlie managed the data analysis team that prepared an extensive review, statistical analysis, and trends analysis of metal concentrations in sediments, waters, and biota sampled at the mining site. Charlie then presented the results of this analysis to the project management team.

Twin Creeks Mine Risk Assessment – Newmont Mining Corporation, Golconda, NV

- The Santa Fe Pacific Gold Corporation was seeking approval from the Bureau of Land Management to expand their gold mining operation at the Twin Creeks facility. As part of the environmental evaluation conducted for the EIS, BLM requested that Sante Fe Pacific conduct a risk assessment to assess impacts on wildlife and human health. Specifically, Charlie managed the evaluation of risks to wildlife from exposure to the future pit lake chemicals leached from the walls of the mining pit; risks to human health from exposure to the future pit lake chemicals for two different pit shape designs; and two separate pit mitigations (leaving the pit unfilled at the end of mining and backfilling the pit post-mining). As the senior author, Charlie developed a report of the detailed risk assessment that concluded that there were negligible risks to wildlife and human health from the future pit lake.

SWAMP Water Quality Assessment – King County, Washington

- Charlie assisted wastewater capital planning, habitat conservation planning, and salmon recovery and watershed planning efforts by developing a set of scientific tools to better understand the Sammamish/ Washington watershed system, and using the tools to explore resource management options. These tools and information included water and sediment quality monitoring results, water quality and quantity modeling, ecological and human health risk assessment, and habitat and biological assessments. The SWAMP project was seeking to understand existing conditions in the study area and identify any associated risks to aquatic life, wildlife, and people and as well as under buildout conditions; and to understand the effects of using reclaimed water in the watershed on existing and future conditions and resulting potential risks.

Barrick Goldstrike EIS - Barrick Resources, Salt Lake City, UT

- Charlie assisted Barrick Resources with developing responses to comments received on the Barrick Goldstrike EIS, through the preparation of a conceptual site model to describe the specific receptors of concern and their pathways of exposure to constituents that are predicted to be present in the future Pit Lake that will develop at the Goldstrike facility following mine closure. Additionally, he developed a narrative risk characterization of the conditions of the Goldstrike discharge to the Humboldt River and potential effects on the receiving environment. Finally, Charlie reviewed methods and calculation provided by a third party used to estimate risks from mercury and selenium bioaccumulation in the future pit lake. Risk Assessments for Deloro Mine Site, Ontario—On behalf of the Ontario Ministry of Environment, directed human health risk assessment updates for onsite and offsite exposures to metals.